

Urban disaster resilience: learning from the 2011 Bangkok flood

Pamela L Sitko (2016)

<https://radar.brookes.ac.uk/radar/items/6f55e5b1-60a2-4662-ae87-a5ecbef64c79/1/>

Note if anything has been removed from thesis:

Copyright © and Moral Rights for this thesis are retained by the author and/or other copyright owners. A copy can be downloaded for personal non-commercial research or study, without prior permission or charge. This thesis cannot be reproduced or quoted extensively from without first obtaining permission in writing from the copyright holder(s). The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the copyright holders.

When referring to this work, the full bibliographic details must be given as follows:

Sitko, Pamela L (2016)

Urban disaster resilience: learning from the 2011 Bangkok flood, PhD, Oxford Brookes University

Urban Disaster Resilience: Learning from the 2011 Bangkok Flood



Pamela Sitko

Department of Planning,
Joint Centre for Urban Design

January 2016

*Submitted in partial fulfillment of the requirements
of the award of Doctor of Philosophy at Oxford Brookes University*

Abstract

Reducing disaster risk, managing rapid urbanisation and tackling poverty is an enormous challenge, particularly in vulnerable neighbourhoods in low and middle-income countries. By 2050, two-thirds of the world's population will live in towns and cities, with 95 per cent of future urban expansion in the global South. At the same time, disasters are increasing in frequency, severity and intensity. Poorer people in vulnerable neighbourhoods are least equipped to cope with the threat of disaster. When flooding struck Thailand's capital city Bangkok in 2011, the United Nations estimated that 73 per cent of low-income households were badly affected (UNISDR 2013). With disasters in cities on the rise, current thinking suggests that resilience offers valuable insights for reducing risk.

This research seeks to develop and validate a conceptual framework for understanding urban disaster resilience in low-income neighbourhoods. It combines two urban approaches. The first, complex adaptive systems (CAS), views the city as a combination of inter-dependent parts working together at a multitude of scales that shapes its overall behaviour. The second, urban morphology, seeks to understand the creation of urban form by establishing connections between the city's historical economic, political and social transformations to its modern day form. The conceptual framework was applied to three low-income neighbourhoods in Bangkok affected by the 2011 flood. Through a case study approach, qualitative information was gathered and analysed in order to understand city-scale and neighbourhood level transformations that built patterns of vulnerability and resilience to chronic stresses and acute shocks.

This research concludes that combining CAS and morphology provides a valuable conceptual framework for understanding urban disaster resilience. Such a framework places people at the centre while providing a scalar and temporal analysis of co-evolving acute and chronic risks in urban areas. Moreover, the intersections of CAS and urban morphology identify dimensions of resilience, where human systems and the built environment affect each other in a positive or negative ways – before, during and after a disaster. Overall, this research concludes that resilience needs to be built both before and after a disaster to be effective, and that disaster itself is a test of how systems and the built environment have learned from history about how to cope with and adapt to shocks and stresses. To these ends, urban disaster resilience can be defined as the ways in which the built environment, complex adaptive systems and people interact to cope, adapt and transform in order to reduce disaster risk.

For my Mom and Dad

Acknowledgements

As with any big undertaking, this thesis would not be possible without the generosity of so many people along the way. This journey was one of delightful surprises and profound moments of discovery. I would like to start by thanking the people from the Bang Bua Canal, who so patiently made time to answer my questions and allowed me a glimpse into their lives. In many ways people from the canal have been some of my greatest teachers. I would also like to thank the many key informants who took the time to speak with me. Each one made a valuable contribution towards shaping this thesis.

I would also like to thank my two indispensable collaborators: Professor Georgia Butina Watson for being an inspirational leader with a confidence that carried me through challenging times and Professor David Sanderson for leading me to open the PhD door and for believing in me every step of the way. I had no idea how life changing this journey would be until you arrived, and for that I am profoundly grateful.

To all the staff and students at Oxford Brookes University who attended my research presentations, debated my approaches and helped me refine my thinking – thank you. I especially want to acknowledge and thank Avar Almukhtar, Turki Shoaib, Soroush Nikeghbali, Mohammad Seddighi, Suneela Ahmed, Huiming Liu, Maria Farone, Wang Ye, Nyoman Maha Putra, Longhui Chen, Paul Torrance, Matt Thomson, Eric de Melo, Dimitris Moutaftsis and Regina Mapua Lim. I also thank Michael Hooper, Emma Lucken and Raven Anderson from the Social Agency Group at Harvard University's Graduate School of Design and David Smith, Marianne Knapskog, Ray Prichard, Sabrina Scherzer, Silja Andersen, Catherine Brun and Carolina Daugstead from the Norwegian University of Science and Technology in Trondheim.

To Turk, Avar and Roshna, knowing you has been one of the sweetest parts of this journey. Avar, I have never met a more remarkable person than you, and I could not have done this without you literally sitting beside me day after day.

Last but not least, I thank my family. Particularly, my Mom, Bunnie Sitko; my Dad, Larry Sitko; and my sister, Lori Sitko, for helping me laugh at myself and for daily messages of encouragement and support. I also thank Autumn and Hob Murphy, Shaun Rude and Claire and Dustin Whitney for rallying around me. Thank you to Jessica Carlson and Anjuli Solanki for our daily Skype 'to do' lists. It is love from all of you that constantly replenishes me.

Preface

I began this research in order to learn more about the origin of disasters and how to improve recovery. My first interaction with Bangkok came when I moved from rural Canada to Thailand's capital Bangkok as a high school exchange student where I became immersed in Thai culture and language for a year.

I later returned as a humanitarian aid practitioner working in large and small disasters in a regional role that covered Asia and the Pacific. When Typhoon Ketsana struck the Philippines in 2009, the agency I was working for struggled with how to respond in urban areas where the need was great but the agency's presence was not well established. There were questions of how to help, who to help and where to help. The aid sector's response to Typhoon Ketsana left me with the desire to dig further into urban disaster response in order to improve the way in which disaster prevention and recovery is undertaken in urban contexts.

For me this research took a surprising turn away from humanitarian work into day-to-day development activities when disaster-affected people kept bringing me back to everyday risks. The research shone a spotlight on the following key message: resilience starts well before a disaster, and its presence, however small and fluctuating, significantly impacts the recovery process.

It may be that alongside the humanitarian imperative there is also a 'resilience imperative' that should be respected and regarded as highly. A resilience imperative is the commitment for humanitarian actors to think about the long-term implications of their relief work, and the ways in which it contributes to successful recovery. A resilience imperative also means that development colleagues are committed to disaster risk reduction within their development programmes. The resilience imperative stretches a hand to every single urban actor, suggesting each one is responsible for collaborating to reduce disaster risk and build resilience.

Table of contents

Part I. Existing knowledge	1
Chapter one	2
Introduction	
1.1 Research problem	2
1.1.1 Urban challenges	4
1.1.2 The urban future of disasters	10
1.1.3 The role of resilience in disasters	12
1.2 Research questions	13
1.3 Aim and objectives	14
1.4 Research strategy	14
1.5 Thesis structure	17
Conclusion	21
Chapter two	22
Theoretical and practice-based constructs of urban disaster resilience	
Introduction	22
2.1 Urban	23
2.1.1 Understanding urban and development	23
2.1.2 Conceptualising the city through complex adaptive systems and urban morphology approaches	29
2.1.3 Urban form and risk	35
2.1.4 Economic complex adaptive systems	39
2.1.5 Governance complex adaptive systems	43
2.1.6 Social complex adaptive systems	45
2.2 Disaster	49
2.2.1 Explaining disaster	50
2.2.2 Linking disaster and development	53
2.3 Resilience	60
2.3.1 Theory of resilience	60
2.3.2 Practice of resilience	70
2.3.3 Defining urban disaster resilience for this research	82
Conclusion	83
Part II. Research approach	85
Chapter three	86
A conceptual framework for urban disaster resilience	
Introduction	86
3.1 The conceptual framework's aim	88
3.2 Complex adaptive systems: the framework's horizontal axis	89
3.2.1 Economic flows	91
3.2.2 Governance networks	91

3.2.3 Social dynamics	92
3.2.4 Triangulation: a review of three urban resilience frameworks	93
3.3 Morphology: the framework's vertical axis	99
3.3.1 Topographical layer	101
3.3.2 Movement networks and public open spaces layer	102
3.3.3 Plots layer	103
3.3.4 Buildings and services layer	105
3.4 A conceptual framework for urban disaster resilience	107
3.4.1 Framework justification	108
3.4.2 Analytical tool	110
Conclusion	113
Chapter four	114
Methodological approach	
Introduction	114
4.1 Meta-theories	115
4.1.1 Inductive research approach	115
4.1.2 Interpretivism	115
4.2 Research design	115
4.3 Research methods	119
4.3.1 Data types	119
4.3.2 Method of data collection	120
4.3.3 Methods of data analysis	125
4.4 Case study approach	126
4.4.1 Rationale for using a case study approach	127
4.4.2 Identification of a case study city	127
4.4.3 Identification of case study neighbourhoods	129
4.5 Analytical tool	136
4.6 Methods for validation	138
4.7 Dissemination of results	142
Conclusion	143
Part III. Case studies analysis	146
Chapter five	147
A Systems and morphological analysis of chronic stresses in Bangkok and the Bang Bua Canal	
Introduction	147
5.1 Topography layer	151
5.1.1 Agricultural economy	151
5.1.2 The politics of water management	157
5.1.3 Social connectedness	160
5.2 Movement networks and public open spaces	161
5.2.1 A new international airport and economic opportunity	168
5.2.2 Political battles transform mobility networks and public open spaces	171
5.2.3 Social grounds for information sharing	173

5.3 Plots	175
5.3.1 Neighbourhood savings structures and plot transformation	176
5.3.2 Neighbourhood governance structures	178
5.3.3. Social dynamics and aspirations	180
5.4 Buildings and services	182
5.4.1 Building typologies	182
5.4.2 Renters	186
5.4.3 Planning regulations and access to services	186
5.4.4 Social dynamics expressed through building usage	188
Conclusion	189
Chapter six	192
A systems and morphological analysis of the 2011 flood in Bangkok and the Bang Bua Canal	
Introduction	192
6.1 Topography	194
6.1.1 Summary of the 2011 flood	194
6.1.2 National flood management	197
6.1.3 The social re-framing of disaster and development priorities	201
6.1.4 Economic impact on poorer people	203
6.2 Movement networks and public open spaces	205
6.2.1 City-scale risk reduction, preparedness and mitigation and the impact on local neighbourhoods	205
6.2.2 Free public transport and income generation	206
6.2.3 Public open spaces	208
6.3 Plots	210
6.3.1 Financial pressures related to plots	210
6.3.2 Flood management through the canal network	211
6.3.3 Self organisation at the neighbourhood level	212
6.4 Buildings and services	213
6.4.1 Poor quality housing and vulnerability to flooding	213
6.4.2 Evacuation centres and vulnerable people	218
6.4.3 Government district authorities and local neighbourhood needs	219
Conclusion	220
Chapter seven	224
Case study one – analysis of Bang Bua Neighbourhood	
Introduction	224
7.1 Neighbourhood profile	225
7.2 Topography	229
7.3 Movement networks and public open spaces	229
7.3.1 Road accessibility	229
7.3.2 Public open spaces	232
7.4 Plots	235

7.4.1 Savings groups	238
7.4.2 Governance structures	239
7.4.3 Social dynamics	241
7.5 Buildings and services	243
7.5.1 Robust homes	243
7.5.2 Access to services	247
7.5.3 The role of the community centres	252
7.6 Validating findings	256
Conclusion	256
Chapter eight	259
Case study two – analysis of Saphan Mai Neighbourhood	
Introduction	259
8.1 Neighbourhood profile	260
8.2 Topography	264
8.3 Movement networks and public open spaces	264
8.3.1 Road accessibility	264
8.3.2 Public open spaces	270
8.4 Plots	272
8.4.1 Savings structures	275
8.4.2 Governance structure	277
8.4.3 Fluidity of social tensions	279
8.5 Buildings and services	281
8.5.1 Strong homes versus vulnerable homes	281
8.5.2 Access to services	284
8.5.3 Access to community centres	286
8.6 Validating findings	289
Conclusion	290
Chapter nine	292
Case study three – analysis of Roi Krong Neighbourhood	
Introduction	292
9.1 Neighbourhood profile	293
9.2 Topography	296
9.3 Movement networks and public open spaces	296
9.3.1 Movement networks	296
9.3.2 Public open spaces	300
9.4 Plots	302
9.4.1 Parallel governance systems	305
9.4.2 Social obstacles within the savings group	306
9.4.3 Land conflict	308
9.5 Buildings and services	310
9.5.1 Rental property income	311
9.5.2 Access to services	314
9.5.3 Community buildings and social divisions	315
9.6 Validating findings	320

Conclusion	320
Part IV. New contribution to knowledge	323
Chapter ten	324
Key findings from the case studies	
Introduction	324
Part I: Re-interpreting the findings from individual cases	326
10.1 Bang Bua Neighbourhood	326
10.1.1 Patterns of CAS	326
10.1.2 Dimensions of resilience	329
10.2 Saphan Mai Neighbourhood	332
10.2.1 Patterns of CAS	332
10.2.2 Dimensions of resilience	334
10.3 Roi Krong Neighbourhood	336
10.3.1 Patterns of CAS	337
10.3.2 Dimensions of resilience	340
Part II: Establishing cross-case dimensions of resilience	344
10.5 Dimensions of resilience within the topographical layer	345
10.5.1 Urban poor networks and the collective production of knowledge	345
10.5.2 Urban poor networks demonstrate a capability for analysis, self-representation and agency	346
10.5.3 Where government actions came up short, networks and their partners fill the gap	347
10.6 Dimensions of resilience within the movement networks and public open spaces layer	348
10.6.1 Safety	349
10.6.2 Inclusiveness	349
10.6.3 Income generation	350
10.7 Dimensions of resilience within the plots layer	351
10.7.1 Land tenure	352
10.7.2 Savings groups	353
10.7.3 Governance structures	353
10.7.4 Social capital	355
10.8 Dimensions of resilience within the buildings and services layer	357
10.8.1 Building quality and the politics of participation	357
10.8.2 Inclusive planning and reconstruction processes	359
Conclusion	362
Chapter eleven	365
Generalisable key findings	
Introduction	365
11.1 Connections between case findings and conceptual framework	367
11.2 Connections between the conceptual framework and theory	377
11.3 Evaluation of the conceptual framework and analytical tool	384

11.3.1 Analytical tool	385
11.3.2 Validation of the conceptual framework and analytical tool	386
11.3.3 Refinements to the conceptual framework resulting from the validation process	388
11.3.4 Strengths	388
11.3.5 Limitations	392
Conclusion	395
Chapter twelve	397
Conclusion	
Introduction	397
12.1 Meeting research aim and objectives	397
12.2 Reflections on the research methodology	402
12.2.1 Limitations	402
12.2.2 Strengths	403
12.3 Contribution to knowledge	404
12.3.1 Theoretical contribution	404
12.3.2 Practice-based contribution	405
12.4 Recommendations for future research	408
12.4.1 The connection between technology and resilience	408
12.4.2 The quandary of how to help renters	408
12.4.3 A systems and morphological approach to urban displacement	409
Chapter conclusion	410
Concluding statement	411
Bibliography	412
Appendices	435
Appendix A – Key informants	435
Appendix B – Key informant interview questions	441
Appendix C – Sample of interview transcripts	446
Appendix D – Focus group discussions	453

Acronyms

AADMER	ASEAN Agreement on Disaster Management and Emergency Response
ABA	Area Based Approach
ACCCRN	Asian Cities Climate Change Resilience Network
ADPC	Asia Disaster Preparedness Centre
APG	ASEAN Partnership Group
ASEAN	Association of South East Asian Nations
BRC	British Red Cross
BMA	Bangkok Metropolitan Authority
CAS	Complex Adaptive Systems
CaLP	Cash and Learning Partnership
CBO	Community-Based Organisation
CCA	Climate Change Adaptation
CENDEP	Centre for Development and Emergency Practice
CODI	Community Organisations Development Institute
DDPM	Department of Disaster Prevention and Mitigation
DFID	Department for International Development
DPM	Disaster Prevention and Mitigation
DPU	Development Planning Unit
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ECHO	European Commission Humanitarian Office
FAO	Food and Agriculture Organization
FSIN	Food Security Information Network
HERR	Humanitarian Emergency Response Review
HFA	Hyogo Framework for Action
IASC	Inter-Agency Standing Committee
IDMC	Internal Displacement Monitoring Centre
IDP	Internally Displaced Person
IIED	International Institute for Environment and Development
ICLEI	International Council for Local Environmental Initiatives
IFRC	International Federation of Red Cross and Red Crescent Societies
ILO	International Labor Organization
IMF	International Monetary Fund
IRIN	Integrated Regional Information Networks
IUDD	Infrastructure and Urban Development Division
FGD	Focus Group Discussion
FROC	Flood4 Relief Operations Center
GBP	Great British Pound
GSC	Global Shelter Cluster
MDG	Millennium Development Goal
MOU	Memorandum of Understanding
NTNU	Norwegian University of Science and Technology

NESDB	National Economic and Social and Development Board
NGO	Non-Governmental Organisation
NHA	National Housing Authority
OFDA	Office of Foreign Disaster Assistance
OBU	Oxford Brookes University
PLWD	People Living With Disability
SAP	Structural Adjustment Programmes
SDG	Sustainable Development Goal
SES	Social Ecological Systems
SEWA	Self Employed Women’s Association
SNAP	Strategic National Action Plan
SOPs	Standard Operating Procedures
SCWRM	Strategic Committee on Water Resource Management
THB	Thai Baht
UCL	University College London
UK	United Kingdom
UNICEF	United Nations International Children’s Emergency Fund
UNISDR	United Nations International Strategy for Disaster Reduction
USAID	United States Agency for International Development
USD	United States Dollar
WFP	World Food Programme
WHO	World Health Organization
WHS	World Humanitarian Summit

Tables and figures

Tables

Table 2.3.3a: A list of six frameworks chosen for in-depth analysis. Source: the author

Table 2.3.3b: A list of 26 frameworks chosen for review in relation to urban disaster resilience. Source: the author

Table 4.3.2a: A summary of the types of methods, number of participants and frequency of use (where appropriate).

Table 4.4.3a: Criteria for selecting neighbourhood case studies in Bangkok, Thailand. Source: the author

Table 4.6a: A table listing the findings from each case study on the left and the method for validation on the right. Source: the author

Table 4.6b: A summary of the participants engaged in the validation process, including the institution, participants' nationalities, department and case studies used. Source: the author

Table 4.8: The types of products for dissemination are listed in the left column, the groups that have been targeted in the centre and the method of delivery in the right column. Source: the author

Table 5.1.2: An adaptation of the historical flood events in Thailand. Source: Bangkok Metropolitan Authority cited in Aon Benfield, 2012. Source: the author

Table 7.5.1: A table of the size of houses built in Bang Bua Neighbourhood and the costs associated. Source: the author

Table 8.5.1a: Housing sizes and costs in Saphan Mai. Loans are calculated to a 15-year period. Source: the author

Table 10.0: Chapter structure for identifying urban disaster resilience dimensions. Source: the author

Table 10.1.1a: A summary of the key patterns that arose from analysis of economic, governance and social CAS before, during and after the flood in Bang Bua Neighbourhood. Source: the author

Table 10.1.1b: a summary of the key findings from each CAS discussed Bang Bua neighbourhood. Source: the author

Table 10.2.1a: A summary of the key patterns that arose from analysis of economic, governance and social CAS before, during and after the flood in Saphan Mai. Source: the author

Table 10.2.1b: A list of key dimensions of resilience within economic, governance and social CAS in Saphan Mai. Source: the author

Table 10.3.1a: A summary of the key patterns that arose from analysis of economic, governance and social CAS before, during and after the flood in Roi Krong. Source: the author

Table 10.3.1b: A list of key dimensions of resilience within economic, governance and social CAS in Roi Krong. Source: the author

Table 10.4: An overview of the key dimensions of resilience within economic, governance and social CAS in Bang Bua, Saphan Mai and Roi Krong neighbourhoods. Source: the author

Table 10.8.2a: A summary table of the dimensions of resilience in four different morphological layers. Source: the author

Table 11.0: A summary of the structure used to establish connections between theory and practice in Chapter Eleven. Source: the author

Table 11.3.2a: A summary of the institutions, participants and their nationalities, department and case study used during the validation process. Source: the author

Figures

Figure 2.2.1a: An interpretation of the Pressure and Release Model from (Wisner et al., 2004), which illustrates that a disaster occurs when vulnerability meets a hazard. Source: the author

Figure 3.1a: The CAS aspect of the conceptual framework is represented in blue (horizontal axis), and analyses patterns of resilience, risk, capacity and vulnerability. The morphological element of the conceptual framework represented in green (vertical axis), analyse changes within the built and natural environment. Source: the author

Figure 3.2a: A diagrammatic representation of overlapping economic flows, governance networks and social dynamic CAS. Source: the author

Figure 3.2.4a: An interpretation of The Resilience Alliance's (2007) key themes for building the urban resilience within a city and its component parts. Source: the author

Figure 3.2.4b: The author's framework builds on the knowledge of the Resilience Alliance (2007) by using similar social and governance systems while making modifications to the way in which economic systems is understood (as indicated in blue). Urban form is indicated in green and will be given greater emphasis through a morphological analysis. Source: the author

Figure 3.2.4c: An interpretation of da Silva *et al.*'s (2012) model of the city as an open system shows that smaller levels of governance i.e a district, has a strong ability to control networks inside of its administrative boundaries (as indicated in the top gray box), and as the level of government grows in size i.e. multiple districts are under the control of a single authority, a reduced ability to influence networks inside and outside of its boundaries is seen. Source: the author

Figure 3.2.4d: An interpretation of The City Resilience Framework (da Silva, 2014). The four categories of urban resilience are highlighted in blue. Source: the author

Figure 3.3: Four morphological layers used in the conceptual framework include the topography layer; movement networks and public open spaces layer; the plots layer; and the buildings and services layer. Source: the author

Figure 3.3.1: A visual graphic of the way in which the three key CAS intersect with the topographical layer. Source: the author

Figure 3.3.2: A graphic of the way in which the three key CAS intersect with the movements network and public open spaces layer. Source: the author

Figure 3.3.3: A graphic of the way in which the three key CAS systems intersect with the plots layer. Source: the author

Figure 3.3.4: A graphic of the way in which the three key CAS intersect with the building and services layer. Source: the author

Figure 3.3.1: A conceptual framework of urban disaster resilience. The blue horizontal axis represents CAS deemed most relevant to urban disaster resilience. The green vertical axis represents morphological layers used to analyse the quality of place in different layers of the built and natural environment. Culled together into one framework, the intersections between human elements of CAS and morphological layers create dimensions of disaster resilience. Source: the author

Figure 4.2: An overview of the research design demonstrates how each chapter contributes to the fulfillment of a research objective. Source: the author

Figure 4.4.2a: A map of Bangkok, the capital city of Thailand. Source: the author adapted from the (Department of City Planning, 2014c)

Figure 4.4.3a: A satellite image of the Bang Bua Canal in northwestern Bangkok. The three neighbourhoods chosen as case studies are located along a three-kilometre stretch of canal. The neighbourhoods are Saphan Mai, Bang Bua Neighbourhood and Roi Krong. Source: (Department of City Planning, 2014b)

Figure 4.4.3b: A view of Bang Bua Neighbourhood. Source: the author

Figure 4.4.3c: A view of Saphan Mai. Source: the author

Figure 4.4.3d: A view of Roi Krong (houses on the left). Source: the author

Figure 4.5: An analytical tool for understanding urban disaster resilience. Source: the author

Figure 5.0a: A map of Bangkok indicating the location of the Bang Bua Canal straddles two administrative districts: Lak Si on the left and Bang Khen on the right. Source: BMA (Department of City Planning, 2013d)

Figure 5.0b: A map of the Bang Bua Canal, depicting Saphan Mai at the bottom, Bang Bua neighbourhood in the middle and Roi Krong neighbourhood at the top. Source: (Department of City Planning, 2014b)

Figure 5.1.1a: An elevation map of Bangkok with the locations of the neighbourhoods depicted. Neighbourhood one is Bang Bua neighbourhood. Neighbourhood two is Saphan Mai. Neighbourhood three is Roi Krong. Source: (Department of City Planning, 2013a)

Figure 5.1.1b: A map of the rivers, canals and waterways in present day Bangkok. Neighbourhood 1 is Bang Bua. Neighbourhood 2 is Saphan Mai. Neighbourhood 3 is Roi Krong. Source: (Department of City Planning, 2013c)

Figure 5.1.1c: A 1968 map of Bangkok reflects a primarily rural landscape with vast rice fields. Black dots indicate few houses existed along the canals, including the Bang Bua Canal. Major roads and highways have remained the same. A black arrow indicates the Bang Bua Canal. Source: (Royal Thai Survey Department, 1968)

Figure 5.2a: A historical perspective of mobility networks in Bangkok. Rice fields are abundant amongst road and railway infrastructure. Source: (Royal Thai Survey Department, 1968)

Figure 5.2b: A view of Phaholyothin Road, an eight-lane highway that crosses the Bang Bua Canal. Source: the author

Figure 5.2c: Types of roads within each neighbourhood. Source: the author

Figure 5.2d: Photographs of the public open spaces that exist within each of the three case studies. Source: the author

Figure 5.2.1a: A vendor parks her tea and coffee cart on the pedestrian lane but opens for business when customers arrive. Source: the author

Figure 5.2.1b: Bottles and other recyclable goods are stored on the pedestrian roadway. Source: the author

Figure 5.2.1c: A vendor pushes a cart of dried squid for sale through Bang Bua Neighbourhood (case study one). Source: the author

Figure 5.2.1d: Fish farms are located against the canal wall on the right side of the photo. Source: the author

Figure 5.2.1e: Residents fishing along the canal to supplement their diets. Source: author

Figure 5.2.1f: The public open space under the orange roof tent has been appropriated by a restaurant owner. Source: the author

Figure 5.2.1g: The public open space under the orange roof hosts a food stall. Source: the author

Figure 5.2.2a: A map of the official open spaces in Bangkok. The Bang Bua Canal is indicated on the map as open space, demonstrating the contraction between government master plans and reality. Neighbourhood 1 is Bang Bua. Neighbourhood 2 is Saphan Mai. Neighbourhood 3 is Roi Krong. Source: (Department of City Planning, 2013b).

Figure 5.2.2b: Waste removal services available in Bang Bua neighbourhood (case one). Source: the author

Figure 5.2.2c: Canal maintenance services provided by the government. Source: the author

Figure 5.2.3: Pedestrian roads in Bang Bua Neighbourhood are places for socialising and for temporarily parking motorcycles. Lighting, humps and loud speakers contribute to overall safety. Source: the author

Figure 5.3.3a: Government and military personnel giving anti-drug speeches to canal residents. Source: the author

Figure 5.3.3b: Military, government staff and canal residents from different neighbourhoods (adults and children) march in solidarity against drugs through different neighbourhoods. Source: the author

Figure 5.4.1a: A mix of single unit housing and semi-detached housing made of concrete, wood or a mixture of both. A number of building typologies that can be found in the canal range from apartments to double storey terraced houses, single and double storey wooden houses on stilts, dormitories and single storey cement homes. Source: the author

Figure 5.4.1b: There are two types of community centres. The first is built of cement as shown in the top left and right photo and bottom left photo. The second is an outdoor gazebo structure, often seen in hotter climates as shown in the bottom right photo. Source: the author

Figure 5.4.1c: A health centre a few hundred metres from Bang Bua Neighbourhood. The clinic is a single story building made of cement. Source: the author

Figure 5.4.1d: A library shared between two neighbourhoods. The building is constructed of cement. The exterior of the building is shown on the left and the interior on the right. Source: the author

Figure 7.1.1 Bang Bua Neighbourhood shows no signs of the 2011 flood, three years after the event took place. Source: the author

Figure 7.1.2: A building use map from the Bangkok Metropolitan Authority that shows Bang Bua Neighbourhood located between a military base and the Bang Bua Canal. Residential buildings are indicated in yellow. Source: (Department of City Planning, 2014a).

Figure 7.3.1a: This map of Bang Bua Neighbourhood indicates primary pedestrian lanes (with motorcycle access) in red and alleyways in yellow. Source: (Bang Bua Neighbourhood, nd-d)

Figure 7.3.1b: This photograph shows a pedestrian size entrance to Bang Bua Neighbourhood via the shortcut through the military base. Source: the author

Figure 7.3.1c: This map of the planned reconstruction in Bang Bua Neighbourhood indicates houses in orange and public open spaces located in front of the library in blue (top), at the community centre (middle) and next to the Tamarind tree (bottom). Source: (Bang Bua Neighbourhood, nd-e)

Figure 7.3.1d: A photo of the public open space that was cleared for children to play safely in the centre of the neighbourhood instead of in parking lots. Source: the author

Figure 7.4a: A map of Bang Bua Neighbourhood before the re-blocking of plots took place. Each colour signifies a group of houses that shifted their plots to live next to each other. Source: (Bang Bua Neighbourhood, nd-a)

Figure 7.4b Bang Bua Neighbourhood after 100 per cent of the re-blocking took place. Source: (Bang Bua Neighbourhood, nd-e)

Figure 7.5.1a: A drawing of strong, safe houses, created during a focus group discussion (BBFGD2) with eight Bang Bua Neighbourhood residents. The drawing highlights the difference between perceptions of a strong home (blue) and a weak one (red). Source: Bang Bua FGD2 on 2 March 2014

Figure 7.5.1b: Qualities described in the picture created by participants in the focus group discussion mentioned above can be seen in the actual houses in Bang Bua Neighbourhood. For example, two and three storey homes with cement foundations and frames as shown in this photo of Bang Bua Neighbourhood. Source: the author

Figure 7.5.1c: A terrace or 'sala' for outdoor socialising was listed as an important quality of a house. Source: the author

Figure 7.5.2a: Meters for water and electricity (right) monitor consumption for individual households. Source: the author

Figure 7.5.2b: A map of Bang Bua Neighbourhood's water supply shows the main pipe (indicated in solid green) is located on the canal side, and that smaller pipes (indicated in dotted green lines) have been laid to service houses further from the canal. Source: (Bang Bua neighbourhood, nd-b)

Figure 7.5.2c: A map of Bang Bua Neighbourhood's drainage system shows the primary drainage pipe (indicated in solid blue) is located along the canal, and that smaller pipes (indicated in dotted blue lines) have been laid to service houses further from the canal. Source: (Bang Bua Neighbourhood, nd-c)

Figure 7.5.2d: The upgrading included a waste collection service by the district government. A government boat accesses the waste from a jetty. Source: the author

Figure 7.5.2e: Weekly weed collection by the municipal government improves canal water flow. Source: the author

Figure 7.5.3a This map shows Bang Bua Neighbourhood's community centre (blue) is located near the main entrance. Source: (Bang Bua Neighbourhood, nd-e)

Figure 7.5.3b: The façade of the public library in Bang Bua Neighbourhood (top) and the inside (bottom) showing a child friendly environment with books and table to read at. Source: the author

Figure 8.1.a: Saphan Mai in the process of reblocking and reconstructing the last phase of houses. Source: the author

Figure 8.1b: A municipal building use map shows Saphan Mai residential buildings in yellow. Saphan Mai neighbourhood is indicated by a black dotted line. Source: (Department of City Planning, 2014d)

Figure 8.3.1a: A wooden bridge from a main road offers pedestrian access to Saphan Mai. Source: the author

Figure 8.3.1b: One entrance to Saphan Mai through an apartment parking lot. Source: the author

Figure 8.3.1c: A third entrance to Saphan Mai along the backside of an apartment block. Source: the author

Figure 8.3.1d: There are three entrance points to Saphan Mai, starting with the bridge on the left, and two entrances through an apartment parking lot located in the centre of the map. Source: (Department of City Planning, 2014d)

Figure 8.3.1e: The main pedestrian lane runs through the centre of the neighbourhood, and is illustrated in gray. Although the map shows building use as recorded by the municipal government in 2009, the larger roads remain relatively unchanged. A more updated map was not available. (Department of City Planning, 2014d)

Figure 8.3.2a: A photo of public space located at the centre of Saphan Mai is used for a meeting between residents regarding a funding proposal to the district authority for development activities. Source: the author

Figure 8.4a: A map of Saphan Mai before the upgrading process began. Source: (Saphan Mai, 2004)

Figure 8.4.2a: A diagrammatic representation of the overlaps between a husband, wife and daughter who hold key leadership positions in Saphan Mai. Source: the author

Figure 8.5.1a: A single story wooden home built on stilts in Saphan Mai neighbourhood. This type of housing is vulnerable to flooding. Source: the author

Figure 8.5.1b: Homes less vulnerable to the floods were constructed from a mix of concrete, wood and brick as shown in the photo of a house frame on the left. Less vulnerable homes have two stories as shown in the photo on the right. Source: the author

Figure 8.5.2a: Sewerage tanks pictured in front of the community building are fitted into the newly reconstructed homes. Source: the author

Figure 8.5.2b: A rubbish collection point next to the tent at the centre of the neighbourhood. Source: the author

Figure 8.5.3a: A two-storey community building where administrative work takes place. Source: the author

Figure 8.5.3b: A view of the World Vision Thailand tent intended to be used as a community building but is instead host to a food stall for personal economic gain. Source: the author

Figure 8.5.3c: Saphan Mai residents frequent the food stall that is set up in an area designed as a community building. Source: the author

Figure 9.1.a: Roi Krong neighbourhood (left). Low quality homes on the canal block the view of more affluent homes built on the landside of the neighbourhood. Source: the author

Figure 9.1b: A building use map that shows Roi Krong's location along the canal perpendicular to the main highway. Source: (Department of City Planning, 2014d)

Figure 9.3.1a: Roi Krong has one narrow pedestrian lane that runs through the centre of it as shown in the photo above. Source: the author

Figure 9.3.1b: There are three pedestrian entrances to Roi Krong as shown in the building use map of Roi Krong above. Source: (Department of City Planning, 2014d)

Figure 9.3.1c: An eight-lane highway is the primary entrance to Roi Krong. Source: the author

Figure 9.3.1d: Access to Roi Krong is gained through a narrow road that runs parallel to the bridge incline. Source: the author

Figure 9.3.2a: A view to the left of the bridge of the fruits and vegetables stands that are hosted in the public open space within the road network in Roi Krong. Source: the author

Figure 9.3.2b: A view to the right of the bridge of the fruits and vegetables stands that are hosted in the open public space within the road network in Roi Krong. Source: the author

Figure 9.3.2c: The space under the narrow incline of the bridge is used for storing goods and socialising in Roi Krong. Source: the author

Figure 9.3.2d: A mesh wire fence has been put up to prevent homeless people and drug users from accessing the public open space in Roi Krong. Source: the author

Figure 9.4a: The blue cement fence (left) and the corrugated iron fence (right) are examples of the fences that surround outdoor living space in Roi Krong. Source: the author

Figure 9.5.1a: A dormitory with large, pleasant outdoor spaces for people to socialise in. Source: the author

Figure 9.5.1b: A second dormitory with large private open space with a table and an outdoor bed. Source: the author

Figure 9.5.1c: A third dormitory with large private open space with a table. Source: the author

Figure 9.5.1d: A photograph of a room rental within one of the houses in Roi Krong. Source: the author

Figure 9.5.3a: Roi Krong's health centre (left) and community centre (right) used by Baan Mankong supporters. Source: the author

Figure 9.5.3b: Roi Krong's sala used by supporters of the elected leader. Source: the author

Figure 9.5.3c: A diagram of the community buildings in Roi Krong shows that all three buildings share a plot boundary, each with their own separate user groups. Source: the author

Figure 9.5.3d: A notice board inside the Roi Krong community centre. Source: the author

Figure 9.5.4e: Important notices posted outside the Roi Krong community centre on its fence. Source: the author

Figure 10.1.2a: The conceptual framework with dimensions of resilience from Bang Bua neighbourhood plotted at different intersections between CAS and morphological layers. Source: the author

Figure 10.2.2a: The conceptual framework with dimensions of resilience from Saphan Mai neighbourhood plotted at different intersections between CAS and morphological layers. Source: the author

Figure 11.1: The conceptual framework with key dimensions of resilience plotted at the intersections between CAS and morphology. The dimensions were identified in Chapter Ten through a cross-case analysis. Source: the author

Figure 11.1a: The conceptual framework with key dimensions of resilience plotted on it. Social dynamics were identified as influential at every morphological layer, therefore suggesting that social dynamics an important CAS for poorer urban people. Source: the author

Figure 11.1b: Four dimensions of resilience are identified at the plot layer: secure land tenure, financial mechanism, governance mechanisms and social agency. Source: the author

Figure 11.2e: An illustration demonstrating that resilience building occurs before a disaster strikes as indicated by the arrows on the left. The dotted lines in the graphic illustrate the four morphological layers where

resilience building takes place. The middle section indicates that the disaster event serves as a test of resilience. Source: the author

Figure 11.2f: An illustration demonstrating that resilience building occurs before a disaster strikes and again after the disaster as indicated by the arrows on the right and left. The dotted lines in the graphic illustrate the four morphological layers where resilience building takes place. The middle section shows that the disaster event serves as a test of resilience. Source: the author

Figure 11.3a: A conceptual framework that blends CAS and morphological approaches into a single framework for interrogating urban disaster resilience. Source: the author

Figure 11.3.4a: A sample of the comments from participants at NTNU regarding the usefulness of the conceptual framework and analytical tool. Source: the author

Figure 11.3.4b: A vignette from a British Red Cross aid worker about the transferability of the conceptual framework. Source: FGD BRC

Figure 11.3.5a: A sample of the analytical tool applied to a case study of the 2010 Haiti earthquake by students from NTNU. Arrows are drawn in the boxes to show linkages between the morphological layers and CAS. Source: the author

Figure 12.3.2a: Practical and theoretical contributions to knowledge are indicated with black arrows in the research design above. Source: the author

Part I. Existing knowledge

Chapter one

Introduction

This introductory chapter is organised into five sections. The Research Problem section defines the problem and establishes the parameters of this research. The Research Questions section identifies the questions that will guide the inquiry and address the research problem. The Aim and Objectives section articulates the purpose of the study and the sequence of steps that will assist in the achievement of the aim and objectives. The Research Strategy explains the approach and stages for achieving the aim and objectives by relating each of the stages to corresponding chapters. The Thesis Structure section describes each of the chapters and the ways in which they contribute to fulfilling the overall research aim.

1.1 Research problem

Cities represent two percent of the earth's land use, consume 60-80 per cent of the world's energy and are host to half the population of the globe (Allen et al., 2012). By 2050, 66 per cent of the world's population is expected to be urban, with nearly 90 per cent of the increase concentrated in Asia and Africa (United Nations, 2014). Lower and middle-

income countries are estimated to host 95 per cent of future urban expansion, posing the enormous challenge of managing rapid urbanisation and alleviating poverty (Allen et al., 2012). At the same time the world is seeing an increase in the frequency, severity and intensity of natural hazards (Djalante, Holley and Thomalla, 2011). Disasters caused by natural hazards – earthquakes, tsunamis, cyclones and flooding – are estimated to cost US \$314 billion per year (UNISDR, 2015b). Moreover, the 2015 Global Assessment Report on Disaster Risk Reduction (2015b), estimates that between 1980-2012 damage as a result of internationally reported disasters is equivalent to 42 million years of economic and social development loss. Measuring the impact of disasters in years of human development loss, the report argues, is more representative than any other metric because it includes time lost on economic and social progress.

Within the category of natural hazard, flood risk has been found by Swiss Re, a Swiss reinsurance company, to threaten more people in urban centres than any other natural hazard (2013). In 2011, when flooding struck Thailand's capital city Bangkok, the United Nations International Strategy for Disaster Reduction (UNISDR) estimated that 73 per cent of low-income households were impacted compared to 21 per cent of the entire city population (UNISDR 2013). With the increase of disasters in cities, current thinking suggests that resilience can address some of the key urban issues by connecting planners, local government and the private sector on humanitarian and development issues (Habitat III, 2015f).

The next section will outline key urban challenges, concerns regarding the future of urban disasters and the role resilience can play to address these challenges in order to help identify where knowledge exists and where there are gaps (de Vaus, 2001).

1.1.1 Urban challenges

Urban areas can be seen as centres of opportunity because of a diversity of jobs, education, specialised healthcare and cultural diversity (McClean, 2010). Through urban centres, nations have gained wealthier economies by investing in international trade and production (Satterthwaite, 2002). The International Federation of Red Cross and Red Crescent Societies (IFRC) notes that ‘well-run cities can be among the safest places on earth’ or among the most dangerous when resources and political will are not present to ensure the provision of basic services such as ‘food security, policing, running water, sewerage and respect for building codes’ (McClean, 2010, p.8). Gilbert and Gugler (1992) note that state and city planning has attempted to address urban risks and challenges by striving to allocate resources more fairly between competing groups, but have been unsuccessful because of people with political power who are able to influence planning decisions that ultimately bypass the interests of those with limited power. This therefore supports the point that key urban trends are building everyday and disaster risk into cities, making urban living risky, especially for poorer people, who are almost always also the most vulnerable.

The research problem for this thesis is formulated, in part, by four key urban trends that create the conditions for everyday and disaster risk within cities. They are: rapid urbanisation; growth in economic inequality; growth in informal settlements; and inadequate infrastructure. Each of these is discussed below.

a.) Rapid urbanisation

Rapid urbanisation is often understood as a shift from a predominantly rural to urban society, arguably one of the most complex socio-economic phenomenon of the twentieth and twenty-first century (Allen et al., 2012). Global statistics from 2014 indicate that 54 per cent of the world’s population was living in an urban environment (United Nations, 2014). A

United Nations (2014) report on urbanisation notes that in 1950, only 30 per cent of the world's population lived in urban centres; by 2050 it is projected that 66 per cent of the world's population will be urban. Moreover, it is expected that by 2030, low-income countries will have more people living in urban areas than in rural (Allen et al., 2012).

Unplanned and unmanaged urbanisation can unintentionally build disaster risk through inadequate infrastructure, such as sewerage and piped water, the growth of informal settlements, and growth in economic inequality. Urbanisation also generates inequality and exclusion at rates that are often higher than the national average of a country overall (Habitat III, 2015c). Economic inequality is often linked with gender and spatial inequality, leading to exclusion and discrimination of groups such as slum dwellers, women, migrant workers and minority groups. There is potential conflict between economic growth and the preservation of environmental resources such as forests, water and clean air as pressures from urban population centres diminish resources (Rakodi and Nunan, 2002). McGranhan and Satterthwaite observe that 'although urbanisation brings serious challenges, attempts to inhibit it through exclusionary policies are likely to be socially, economically and environmentally damaging' (2014, p.3). The challenge then, is how to successfully manage urbanisation in a way that creates inclusive and safer cities for all. Having explained key opportunities and challenges within urbanisation, the next section explains the impact of the growth of the informal economy.

b.) Growth of the informal economy

This section highlights the growth of the informal sector and ways in which social and economic risks are built upon a fragile and complex web of inter-relations between the formal and informal.

The informal economy became a named concept in the 1960s and has since been referred to as a shadow economy, a second economy, a parallel

economy and the informal sector (Chant and McIlwaine, 2009). It is estimated that the informal economy accounts for over half of global employment and potentially as much as 90 per cent of employment in low-income countries (Chambwera, MacGregor and Baker, 2011). The World Bank estimates that between one-fifth and four-fifths of the economic outputs in lower-income countries results from the informal economy and between 25 per cent to 40 per cent of annual output in low-income countries in Asia and Africa (The World Bank, 2015).

Conceptually, the key difference between the formal and informal economy is that the formal economy is made up of wage labour with benefits and rights governed by rules and laws concerning property, health and safety, commercial licensing, labour contracts, financial credit and social security (Feige 1990). In contrast, de Soto (1989) argues that the informal economy is a result of people trying to escape the over-regulation, corruption and bureaucratic inefficiency of the state. One of the primary challenges with the informal economy is that it is comprised of self-employed persons, whose labour is not regulated and are often comprised of activities that shortcut costs and are labour intensive (ILO, 2014). Additionally, the informal economy is often present where the state is absent, particularly within the provision of basic services (Chant and McIlwaine, 2009). For example, in settlements dealers provide electricity illegally by tapping into the electricity grid. Water is purchased in containers often at inflated prices or is illegally obtained by tapping into a pipeline. Transport is another example of an informal market with its provision of taxi drivers and buses. Informality also reaches into the land and housing markets, which will be discussed in greater detail in the following section. In practice, formal and informal boundaries blur as labour shifts between the two based on interdependent relationships.

When a disaster such as that caused by a flood strikes, pressure is placed on the inter-relationships between the formal and informal economy,

sometimes causing damage or the collapse of economic systems, markets and supply chains linked to markets. Untangling the relationships and identifying vulnerabilities before a disaster is challenging, and even more so afterwards. Therefore understanding the challenges and responses to the growth of an informal economy is crucial to reducing vulnerability and avoidance of building back systems that do not replicate the same risks and vulnerabilities.

Those in the informal economy are often more vulnerable, because, among other things, of the absence of regulations around decent work conditions, social protection mechanisms such as pensions, health insurance, retirement funds and training opportunities to improve specialised skill sets that enable people to move up the income ladder. Having explained challenges related to the growth of the informal economy, the next section explains how the growth of informal settlements creates new urban risk.

c.) Growth of informal settlements

UN-Habitat describes the growth of urban informal settlements as an 'urban phenomenon' (Habitat III, 2015e). Today, there are over 863 million people living in settlements, equating to over a quarter of the world's population (UN-Habitat, 2013b). The absolute number of settlement dwellers is up from 650 million in 1990 and 760 million in 2000 (UN-Habitat, 2014). When a natural hazard strikes an urban area, informal settlements are often without adequate housing to withstand storms, earthquakes, strong winds and floods. Oftentimes they have limited provision of basic services before a disaster and are therefore often compelled to seek shelter in evacuation centres, with host families or in displacement camps.

Almost a billion people live with insecure property tenure and ambiguous land occupation with direct social and economic implications (UN-Habitat,

2013a). For example, without a formally registered address it can be difficult to find work, receive official documents and even obtain citizenship (Chant and McIlwaine, 2009). De Soto argues that shortfalls in shelter are a consequence of inequitable property rights and tenure policies that prevent poorer people from taking full advantage of their assets, referring to economic assets not recognised formally as 'dead capital' (de Soto, 2000). Gilbert (2002) attributes shortfalls in housing to the fact that it straddles both social and economic policies, and are bottomless in terms of the need and economic input required to fully address shortages. Chant and McIlwaine (2009) argue the lack of adequate shelter comes not just from poverty, but from the failure of the state and a lack of political will to address real need.

In urban areas poorer people engage in numerous housing arrangements – from renting to formal contracts or informal agreements to staying with host families in a situation of multiple occupancy agreements (either sharing the plot or their home) to squatter settlements formed through the invasion of private or publicly owned land or through renting or buying sub-divisions – cheap land, often illegally sold off by brokers or 'owners' who lack authorisation to sell the land. The land where poorer people live is frequently in locations where no one else wants to live due to environmentally or geologically hazardous conditions or out of the reach of transportation and services (Gilbert, 1992). Having explained how the growth of informal settlements is a key urban challenge, the next section explores the impact of inadequate urban infrastructure.

d.) Inadequate infrastructure

Urban infrastructure has traditionally been defined as basic infrastructure and services that include 'the delivery of safe water, sanitation, waste management, social welfare, transport and communications facilities, energy, health and emergency services, schools, public safety, and the management of open spaces' (Habitat II Agenda 1). While infrastructure

has primarily been seen in 'siloes', i.e. separated sectors of physical structures, in the last decade there has been a shift towards a systems based approach (that views cities as inter-dependent 'components' or 'systems', which co-evolve with their changing environment), recognising the complexity of networks, assets, knowledge and institutions associated with infrastructure and the provision of basic services (Habitat III, 2015g). Urban infrastructure is a concern in urban areas for several reasons: sometimes it is poorly built or maintained; becomes ineffective at serving large numbers of users; is not regulated or does not comply with standards or safety codes; and finally, sometimes infrastructure does not reflect new technology advances (Allen, Lampis and Swilling, 2015).

Investments in infrastructure are required to keep cities safe and sustainable, and may in fact shape a second wave of urbanisation (Swilling, 2015). Alongside physical and financial investments in infrastructure, Swilling (2015) argues that governance paradigms are also in need of replacing through incremental urbanism, whereby suppliers and communities co-produce the different means of accessing to services based on the unique conditions of each context. Currently there is a gap between supply and demand; accessibility; and affordability reflecting weakness in urban planning and policy approaches (Habitat III, 2015g).

UN-Habitat estimates that USD 57 trillion in investment into infrastructure is required between 2013-2030 to meet growing global need (Habitat III, 2015g). The World Health Organisation (WHO) and United Nations International Children's Emergency Fund (UNICEF) found that by 2012 over 542 million people did not have access to sanitation and 720 million people did not have access to piped water (WHO and UNICEF, 2014). Globally, UN-Habitat estimates that cities generate over two billion tons of waste and predicts this number will double by 2035 (UN-Habitat, 2010). Such statistics suggest that the research problem therefore, is how to ensure poorer people's needs for water, sanitation, electricity and other

such services are met in ways that are affordable and safe. Furthermore, that access to basic services is assured at some basic level even after a disaster.

Having explained four key urban challenges related to rapid urbanisation, the growth of the informal economy, the growth of informal settlements and the presence of inadequate infrastructure, the next section will focus on the impact natural hazards can have on cities.

1.1.2 The urban future of disasters

When cities are not well managed they can be seen as ‘crucibles of hazards’, generating vulnerability and risk for large populations (Bull-Kamanga et al., 2003, p.196). Natural hazards can be particularly dangerous in cities because high concentrations of people in one space are exposed to the same hazard with varying degrees of preparedness and coping mechanisms. Moreover, in a city there are a greater number of hazards for people to be exposed to including a wide range of infectious diseases, proximity to dangerous industrial processes and the potential for road accidents (Bull-Kamanga et al., 2003). It is the interdependence of urban systems with natural and constructed hazards that makes it difficult to identify and reduce risks. It is therefore important that analysis of urban disaster risk includes an understanding of the underlying everyday risks (i.e. the inability to afford health care, to eat nutritious meals each day, to walk to school without fear of attack, or to live in a safe, adequate home) that shape urban vulnerability as much as the disaster risks associated with particular hazards.

Literature suggests that there is not enough evidence around what works best in disaster recovery in urban contexts, and that further research on a number of topics is advised. In a review of humanitarian responses to urban crises, Brown *et al.* (2015) make four recommendations for strengthening humanitarian response in urban settings. The first is to reframe the problem by focusing on different approaches to better

understanding systems, processes and context. It suggests that asking 'why' urban is different is required in addition to seeking 'how'.

The second recommendation is to look outside humanitarian interventions by investigating aspects of time and history in order to understand what was 'normal' in a particular area before a disaster struck. Analysing pre-disaster contexts may provide an understanding of what is 'normal' and therefore how to improve recovery. A post-disaster context does not offer the same opportunities because 'normal' processes are disturbed. Moreover, knowing that humanitarian aid reaches a limited segment of the population means that research into self-recovery dynamics and partnerships could present new learning opportunities.

The third is to broaden traditional methods and scope of research across multiple sectors, scales and data collection methods. The authors suggest that quality and validity can be severely compromised when research on a dynamic context is conducted over too short a time span, and therefore suggest support for longitudinal studies to understand transformations over time. Furthermore, the authors suggest more research be conducted on urban areas from a complex systems approach that reaches across sectors and scales in a holistic way.

The fourth and final recommendation is to co-produce knowledge and evidence with local actors in order to take into account local understandings, perceptions and knowledge. For example, the authors suggest 'subject briefings' where land administration, urban planning, and building codes and regulations are explained or mapped with a possible questions and answer session at the end. They also suggest 'experience briefings' where local actors share experiences and lessons learned responding to a crisis in the same area or nearby location.

1.1.3 The role of resilience in disasters

The concept of resilience has been introduced into the disaster lexicon, but evidence is still emerging regarding why and how resilience saves and protects lives (Boin, Comfort and Demchak, 2010). While the concept is relatively new to disaster management and is still debated, it forms the basis for many of the current practical frameworks in the areas of relief and development (Combaz, 2015). Yet, there is skepticism about the optimistic use of the concept. Levine *et al.* (2012) argue that a bigger body of empirical knowledge is necessary in order to understand what it means to build resilience in specific crises and how resilience can realistically be achieved after a disaster. The authors write that 'current ways of portraying resilience are not useful as a guide in diagnosing people's vulnerability, and are also too vague to help designing any policies or programmes for building resilience' (Levine et al., 2012, p.1). Bahadur et al (2010) note that resilience is not only used in reference to disasters but is increasingly raised in discussions on policies and programming in climate change adaptation and disaster risk reduction, however with minimal scrutiny of how it might influence the ways in which it is operationalised.

Manyena (2006) writes that resilience is viewed as a positive concept that focuses on the ability of disaster affected communities to 'bounce back' with little or no external support. However some are concerned that bouncing back could be dangerous for communities and systems that are returning to an undesirable state of vulnerability and exposure (Pelling, 2011a). Moreover, the concept of self-reliance risks laying the ground work for governments to abscond from their duties to protect citizens from harm (Griffin, 2011). Cannon and Muller-Mahn (2010) note that a shift from vulnerability analysis to resilience analysis could be dangerous if it weakens the emphasis on the socio-economic construction of hazards and risk in favour of highlighting a natural science perspective.

Amid other concerns regarding resilience is that its definition is too broad, risking becoming meaningless if it is a catch all phrase that encompasses everything good (Bruijne, Boin and van Eeten, 2010). Moreover, because there is no agreed upon definition of disaster resilience, measuring it becomes a significant challenge due to what some call a lack of standards (Winderl, 2014).

Therefore there is a need to understand better what is meant by urban disaster resilience in light of the many definitions and demands for further evidence of how resilience can be operationalised. This research sees the need to ask critical questions about urban disaster resilience from a socio-spatial perspective in order to develop a conceptual framework for building resilience in low-income neighbourhoods.

1.2 Research questions

The main research question, derived from the research problem discussion above is: What is an appropriate approach for understanding urban disaster resilience in low-income settlements?

The following sub-questions guide the research design:

1. What is an appropriate conceptual framework for exploring urban disaster resilience?
2. What is an appropriate method for analysing disaster resilience within low-income neighbourhoods?
3. What city-scale transformations build resilience or vulnerability to chronic stresses and acute shocks?
4. What are the key dimensions of resilience at different scales in a neighbourhood across time?
5. What can be generalised beyond this research from the case study findings and the conceptual framework?

1.3 Aim and objectives

In order to answer the research questions, the overall aim of this research is to develop and validate a conceptual framework for understanding urban disaster resilience in low-income neighbourhoods.

In order to achieve the aim, the following five objectives have been set:

1. Objective one: to formulate a conceptual framework for exploring disaster resilience in low-income neighbourhoods.
2. Objective two: to develop a methodology for analysing disaster resilience within low-income neighbourhoods.
3. Objective three: to apply the methodology in three low-income neighbourhoods to identify key findings and dimensions of resilience.
4. Objective four: to validate findings and the conceptual framework with key actors.
5. Objective five: to identify the generalisable results of the case studies and conceptual framework for building urban disaster resilience in low-income neighbourhoods.

1.4 Research strategy

This research draws on both theory and practice by employing a deductive and inductive research strategy. It is deductive through its reliance upon a literature review of current theories and practices in order to develop a conceptual framework. However, it is also inductive through its use of specific observations from case studies in order to make generalisations that link with theory. Both deductive and inductive strategies are complimentary approaches for analysing the complexity of reality.

Furthermore, the research adopts a qualitative research strategy as the primary method of data collection and analysis in order to account for

social attitudes and perceptions; as well as the fluid and ever-changing concept of reality (Bryman, 2008). Moreover, a qualitative research strategy was chosen because it views the researcher as an active learner (Creswell, 2007).

A case study combined with theory is used as a means of understanding what urban disaster resilience is in the context of low-income neighbourhoods. The case of a flood disaster along the Bang Bua Canal in Bangkok, Thailand in 2011 was chosen. In this research, a case study is the primary method of inquiry because the point of a case study is to see if theory works in real life or if it needs refinement or is applicable only in certain circumstances (de Vaus, 2001).

The case study of Bangkok is analysed using qualitative methodologies from a range of disciplines, including planning and the use of urban morphology (Whitehand, 2001; Butina Watson et al., 2004; Moudon, 1997); disaster and development studies and the use of participatory rapid appraisal (Chambers, 2002; IFRC, 2007b; Pretty et al., 1995) and ecology with the use of human environment interaction methodologies (Holling, 2001; Folke, 2006; Bar-Yam, 1997b). The research methods include analysis of city plans, neighbourhood maps, historical photos, key informant interviews, focus group discussions, workshops and participant observation.

The research has five stages, each of which is described individually below.

Stage 1: Develop a conceptual framework

In stage one a literature review of theory and practice related to cities, disasters, development and resilience is undertaken in order to design a conceptual framework for exploring urban disaster resilience (Chapters One, Two and Three).

Stage 2: Develop a methodological approach

In stage two a methodology for analysing disaster resilience within low-income neighbourhoods (Chapter Four) is developed based on the conceptual framework conceived in stage one. An analytical tool for practitioners that links to the conceptual framework is also developed.

Stage 3: Data collection and analysis

In stage three the methodology for analysing disaster resilience is used on the case study in order to collect and analyse data at a city level (Bangkok) and at a neighbourhood level (specifically in three neighbourhoods in the Bang Bua Canal) (Chapters Five, Six, Seven, Eight and Nine). Key dimensions of resilience are defined within each neighbourhood. Dimensions of resilience are defined in this research as the interaction between the built environment and economic, governance and social systems.

Stage 4: Propose common dimensions of resilience

In stage four common dimensions of resilience are proposed from the case studies and re-interpreted to establish cross-case dimensions of resilience (Chapter Ten).

Stage 5: Validate conceptual framework and analytical tool and draw conclusions

In stage five urban professionals from academia and practice validate the conceptual framework and accompanying analytical tool in order to identify elements of generalisability (Chapter Eleven). Conclusions about the research are then drawn, including the research's limitations and strengths, the ways in which it met the aim and objectives and recommendations for further research (Chapter Twelve).

1.5 Thesis structure

This thesis is organised into twelve chapters that address the research questions and fulfill the aim and objectives of this research. This section explains the role of each chapter and summarises the content.

Chapter One: Introduction

This chapter introduces the research problem as a question of what are the key approaches for understanding urban disaster resilience in low income settlements. It then introduces key research questions, the thesis' aim and objectives as well as its overall research strategy in order to provide an overview of the thesis for the reader.

Chapter Two: Theoretical and Practice-Based Constructs of Urban Disaster Resilience

This chapter identifies key theoretical and practical constructs of cities, disasters, development and resilience. It reviews key debates, conceptualisations and frameworks in order to understand the ways in which the concepts interact, and provide input into addressing the research sub-question, 'What is the most appropriate conceptual framework for exploring urban disaster resilience?'

Chapter Three: A Conceptual Framework for Urban Disaster Resilience

This chapter answers the research sub-question, 'What is the most appropriate conceptual framework for exploring urban disaster resilience?' by developing a conceptual framework that incorporates key concepts and theories reviewed in the literature. The conceptual framework chapter specifically focuses on the interaction between humans and urban built form as a holistic approach to understanding urban disaster resilience.

Chapter Four: Methodological Approach

This chapter answers the research sub-question, 'What is the most appropriate method for analysing disaster resilience within low-income neighbourhoods?' by using the conceptual framework to develop a research methodology for analysis. The methodological approach establishes methods and techniques for inquiry, data analysis and research validation.

Chapter Five: A Systems and Morphological Analysis of Chronic Stresses in Bangkok and the Bang Bua Canal

This chapter answers the research sub-question, 'What city-scale transformations build resilience or vulnerability to chronic stresses and acute shocks?' The conceptual framework is used to conduct analysis of the historical transformation of Bangkok and the Bang Bua Canal in relation to human interactions between the built and natural environment and everyday risks presented by chronic and acute stresses.

Chapter Six: A Systems and Morphological Analysis of the 2011 Flood in Bangkok and the Bang Bua Canal

This chapter answers the research sub-question, 'What city-scale transformations build resilience to flood shocks?' The conceptual framework is used to conduct analysis of the historical transformation of Bangkok and the Bang Bua Canal in relation to disaster related risks and the impact of the 2011 flood disaster.

Chapter Seven: Case study One: Analysis of Bang Bua Neighbourhood

Chapter Eight: Case study Two: Analysis of Saphan Mai Neighbourhood

Chapter Nine: Case study Three: Analysis of Roi Krong Neighbourhood

Chapters Seven, Eight and Nine answer the research sub-question, 'What are the key dimensions of resilience at different morphological scales in a neighbourhood across time?' The methodological approach analyses systemic patterns of vulnerabilities and capacities in relation to the 2011

flood in order to establish dimensions of resilience before, during and after the flood in the Bang Bua Canal.

Chapter Ten: Key Findings From the Case Studies

This chapters answer the research sub-question, ‘What are the key dimensions of resilience at different scales across time?’ by re-interpreting and consolidating key findings from the case studies in order to establish cross-case dimensions of urban disaster resilience.

Chapter Eleven: Generalisable Key Findings

This chapter answers the research sub-question, ‘What can be generalised beyond this research from the case study findings and the conceptual framework?’ The chapter aims to identify generalisable dimensions of resilience that exist in theory and practice, establishing connections between the case studies and the conceptual framework. The chapter then seeks to evaluate the validity of the conceptual framework and analytical tool through input by urban stakeholders in academia and practice. It then establishes connections between the conceptual framework and general body of theory.

Chapter Twelve: Conclusion

This chapter reviews the process of meeting the research aim and objectives in order to identify the new contribution to knowledge and further areas for research.

Figure 1.5a below provides a visual representation of how the chapters link to thesis objectives.

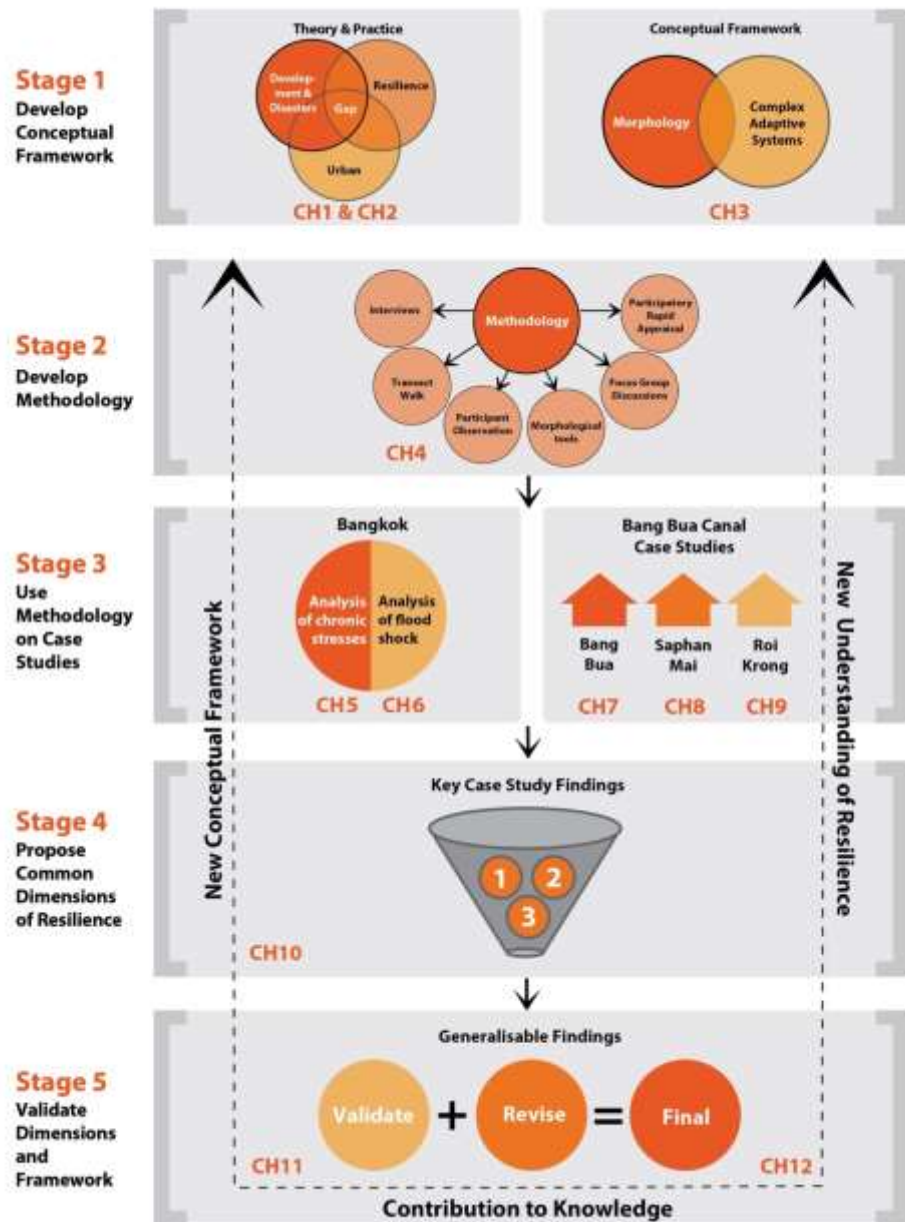


Figure 1.5a: A visual representation of the link between chapters and objectives. Source: the author

Conclusion

This chapter introduced the research problem, highlighting four key urban challenges facing the world today. It then explained the ways in which urban disasters set out new challenges for cities and questioned the usefulness of the concept of resilience in disaster preparedness, response and recovery. The primary research question was then presented, which seeks to investigate what key approaches can be used for understanding urban disaster resilience in low-income settlements; five other sub-questions were stated. A research strategy was then presented, outlining key stages and approaches to the research. The chapter closed with a description of the thesis structure and the purpose of each chapter.

The next chapter provides a literature review of key theoretical and practical constructs drawn from different fields and disciplines that reflect urban complexity in order to formulate a conceptual framework for understanding disaster resilience in low-income neighbourhoods.

Chapter two

Theoretical and practice-based constructs of urban disaster resilience

Introduction

This chapter seeks to examine key theoretical constructs of urban, disaster and resilience in order to develop a conceptual framework for understanding urban disaster resilience. It begins by analysing the links between urban and development through tracing the history of key development theories and their connection with urban growth. It then presents two approaches for conceptualising the city, namely complex adaptive systems and urban morphology. It then specifies key challenges and opportunities within the city beginning with urban form and risks related to the built and natural environment. It then explains the types of economic, governance and social complexities within urban areas from a systems perspective. The chapter then analyses key disaster theories and approaches and where possible, establishes links with cities. Finally, the

chapter closes with an explanation of resilience within urban disaster contexts, critiquing resilience from both theoretical and operational perspectives.

2.1 Urban

This section explains key concepts and debates about cities. It forms the largest part of the chapter in recognition that the literature review on disasters and resilience is conducted in relation to cities. In order to develop an appropriate framework for understanding urban disaster resilience, this section begins with an explanation of how key development theories link with urbanisation. It then explores the application of complex adaptive systems and urban morphology as approaches for understanding inter-relationships within a city. An analysis of urban form and related risks is then presented followed by an examination of what a city conceptually looks like when it is analysed through an economic, governance and social systems lens.

2.1.1 Understanding urban and development

Development and post-development theories have been used to understand cities, mostly in the global South (Williams, Meth and Willis, 2009), but not without critique. This section will outline the key theoretical approaches to the city and corresponding critiques, highlighting current urbanisation trends, opportunities and challenges that arise. It will then present a conceptual analysis of the city using two approaches: urban morphology and complex adaptive systems.

Development theory is an interdisciplinary body of theory that examines economics, politics and culture in order to identify problems and provide solutions for dealing with them (Chant and McIlwaine, 2009). Theories, approaches, ideologies and schools of thought within development are similar in that they are formed around the intention of changing a society

in a concrete and particular way, and in its early days that involved almost exclusively economic growth (Potter, 2002) in urban centres. Much of the theory used today was developed post-World War II (Escobar, 1995). In order to 'modernise' it was believed that urbanisation, industrialisation and economic growth were essential (Williams, Meth and Willis, 2009). To this end, development theory has been influenced by the work of planners, administrators, politicians, and international agencies, including but not limited to non-government organisations (NGOs) and community-based organisations (CBOs) in addition to academics (Chant and McIlwaine, 2009). While there are many development theories and schools of thought, five broad and overlapping ones dating back from the mid 1940s to present day have been selected for analysis, having had a great impact on the formation of urban thinking (Pacione, 2001).

The first is Modernisation theory, which became influential in the 1940s-1960s. Modernisation theory is a school of thought or an approach that posits that development in the global South is done best when it mirrors the processes undertaken in the post-war reconstruction of Europe, resulting in modern, industrialised societies (Hettne, 2002). Modernism is characterised by the drive for industrialisation, commercialisation of agriculture, the introduction of technology, large-scale infrastructure projects and training in cultures and values from the global North. For example, Rostow (1960) used global economic history to develop a model with five key stages of growth. Key to the model's success was the 'take-off' stage where modernising elite invested in industrialisation, which was expected to yield high levels of industrial productivity that would eventually become self-sustaining and diversify into other sectors (Chant and McIlwaine, 2009). The diversified income base would then theoretically 'trickle-down' to other sectors and regions. While this process of industrialisation had taken over one hundred years in nineteenth and twentieth century Britain, Rowstow's model believed this

pace could be accelerated in the global South, taking less than a generation (Williams, Meth and Willis, 2009).

However, by the 1960s there was little evidence in way of economic growth and poverty reduction that suggested modernisation-based policies were working. Moreover, Modernization theory faced critiques of being ethnocentric and not accounting for colonial constraints that prevented a number of countries from freely developing their own strategies and goals for 'development' (Chant and McIlwaine, 2009).

The second theory that gained prominence between 1960s to mid-1970s was Dependency theory, comprising a range of approaches from the global South, specifically Latin America, that believed exploitation by the global North was the root cause of poverty and a lack of economic growth (Handelman, 2009). Dependency theory takes into consideration historical and global contexts as well as colonialism. Baran and Frank, influential dependency theorists challenged capitalist development expectations of the global South (Hettne, 2002). Frank's Marxist perspective posited that the global South should de-link their economies from the global North due to exploitation and an unhealthy relationship of dependency (Hettne, 2002). Dependency theory was critiqued however, for over-generalisation and oversimplification because the theory was primarily based on the Latin American experience. Nor did empirical evidence support the premise that southern countries with the most extensive relationships with northern countries were the poorest and most underdeveloped (Chant and McIlwaine, 2009). However, perhaps the most important critique of Dependency theory is its failure to articulate specific causes of under-development beyond the scope of capitalism (Chant and McIlwaine, 2009; Handelman, 2009).

To address some of the criticisms against Dependency theory, Wallerstein (2004) developed the World Systems theory (widely regarded in the mid-

1970s to mid-1980s), which argued that a country's development prospects are shaped by global economic processes and inter-relationships (Pacione, 2001). It viewed the world as inherently unequal with variations of capitalist potential in different countries at different times due to the possibility of asset accumulation in specific periods of history. However, this theory also suffered from over generalisation and simplification of complex global, national and local economic, political and social processes. Klak (2002) notes that the theory is difficult to test and therefore may be better referenced as a perspective.

The fourth theory is that of neoliberalism, an approach that highly shaped policies and practices within the scope of 'sustainable development' (Escobar, 1995) beginning in the 1980s until today. Williams, Meth and Willis (2009) describe the approach as 'hegemonic' when it first dominated international development practice in the 1980s and 1990s. Neoliberalism is based on the belief that deregulation of markets and promotion of free trade will result in economic development. Neoliberalists posit that minimal state involvement in the market economy provides the necessary space required for social and economic growth.

The main characteristics of neoliberalism include privatisation of state-owned enterprises, increased foreign investment and the elimination of government regulations and protectionism (Chant and McIlwaine, 2009; Escobar, 1995; Williams, Meth and Willis, 2009). Poverty and a lack of economic growth are understood by neoliberals to be a result of an overextended government and a public sector burdened by corruption and inefficiency (Handelman, 2009). Neoliberalism was especially popular in the 1980s through economists Von Hayek and Friedman known as the 'Chicago Boys' who advocated that market forces were the primary mechanism for development and that government interference hindered their growth (Chant and McIlwaine, 2009). Free market policies were

reflected heavily in Thatcherism and Reaganism in the UK and the USA (Pryke, 1999; Williams, Meth and Willis, 2009), both countries that held the majority votes on the boards of the International Monetary Fund (IMF) and the World Bank, which influenced the neoliberalist turns taken by the financial institutions' approach to development in the global South (Chant and McIlwaine, 2009).

In the early 1980s when the 'debt crisis' started, international financial institutions responded with structural adjustment programmes (SAPs) intended to reduce repayments from countries through mobilisation of domestic resources, economic policy reforms, increase in exportation of traditional and non-traditional commodities and the reduction of the state's role in economics (Simon, 2002; Williams, Meth and Willis, 2009). Two measures were put in place. Stabilisation, a short-term measure was a strategy that involved a freeze on public sector wages, a reduction in food subsidies and devaluation of the currency (Simon, 2002). Meanwhile, adjustment measures, a longer-term strategy, focused on export promotion, civil service downsizing, privatisation, tax reductions and the relaxing of economic regulations (Simon, 2002).

Critiques of neoliberal policies were that they were seen to create widespread dependence on international financial institutes; ignored inequalities and instabilities in global markets; perpetuated exploitation of the environment through mineral resource extraction, and promoted the industrialisation of crops and activities that resulted in land degradation. Additionally, neoliberal policies were seen to have taken little account of the impact colonialism had on social and economic structures in the global South. Moreover, from a human perspective, UNICEF noted that SAPs were the source of high unemployment, an increase in the cost of food staples, declining actual wages and reduced spending on social and public services by governments (1987). Urban areas were particularly affected by these policies because civil servants lost their jobs and poorer urban

people became unable to afford the cost of goods and services (Chant and McIlwaine, 2009). Moreover, SAP policies have undermined the ability for many cities to manage urbanisation effectively (Williams, Meth and Willis, 2009).

The fifth and final theory is that of Post-development, which has been a rival movement to the earlier mentioned theories from the 1990s until today. Post-development thinking rejects the meta-theories of Modernisation and Dependency in favour of embracing, 'diversity, context and alternative voices' (Chant and McIlwaine, 2009, p.49). It is a bottom-up approach that employs non-hierarchical strategies that consider each context as unique and individual, is inclusive of local knowledge and promotes equitable power sharing (Willis, 2005). Post-development thinking highlights alternative approaches by focusing on the importance of local voices and excluded perspectives. Post-modernist theorists such as Escobar (1995) believe that the global South has wrongly been treated as one homogenous and uniform context. Post-modernist writers such as Chambers (1997), pose the question: 'whose reality counts?' in response to top-down, development theories, policies and activities imposed on the global South by institutions from the global North. Some Post-development theorists advocate not for 'development alternatives' but for 'alternatives to development... a rejection of the paradigm altogether' (Escobar, 1995, p.215).

Critiques against Post-development theory include the argument that if postmodernisms reject the concept of 'development' then they should provide an alternative. Literature suggests that perhaps it is more helpful not to reject development in its entirety, but to offer clarity over what aspects of development are being rejected such as traditional thinking around how development can be better achieved. Others with a more ecological focus such as Rist, argue that a kind of 'green capitalism' is needed to correct the mistakes of the past by moving away from

economic growth, production and consumption into 'de-growth', large-scale recycling, energy-saving measures and becoming 'conscious objectors to growth' (2014, p.259).

Having explained how development has fostered urbanisation through policies and industrial activities, the next section will provide an analysis of the city through examination of key concepts and elements through a complex adaptive systems and urban morphological approach.

2.1.2 Conceptualising the city through complex adaptive systems and urban morphology approaches

This section analyses the city through a complex adaptive systems (CAS) and urban morphology approaches. It begins with an explanation of CAS and how it can be used to analyse cities.

Complex Adaptive Systems

A city can be difficult to define. Cities fluctuate, are porous and have no clear boundaries (Ramalingam and Knox Clarke, 2012). Kostof (1991) observes that cities are made up of buildings and people. Lynch extrapolates the same idea by writing, 'City forms, their actual functions, and the ideas and values that people attach to them make up a single phenomenon' (1981, p.36). However, urban approaches such as complex adaptive systems and urban morphology can assist with understanding what the city is by reflecting the complexities of interdependencies determined by social, political, physical, natural and economic components of an urban centre. Various component parts of a city behave independently. For example, analysis of a neighbourhood requires knowledge of its component parts, such as the behaviour of households in that neighbourhood, in order to understand what each of the component parts are doing. Yet, from a larger scale it is difficult to differentiate the behaviour of various component parts (in this case the houses), and at times only their emergent behaviour as one system is observable (the

neighbourhood). Therefore, a systems approach focuses on the processes undertaken when component parts interact, and how they behave as one (Bar-Yam, 1997a), which is crucial for understanding urban complexity. Moreover, both approaches allow for scalar and integrative analysis that reflects the myriad of ways in which humans engage with the built and natural environment.

Complex systems theory views the city as a system with internal interdependent component parts working together at a multitude of scales that shape the behaviour and development of a city (Aiken et al., 1987). The city is not only shaped internally but externally as well by other global, national or municipal systems (da Silva, 2014). Complex 'adaptive' systems adapt and co-evolve with their changing environment (da Silva, Kernaghan and Luque, 2012; Holling, 2001), and are sometimes referred to as Social Ecological Systems (SES) in urbanisation and climate change debates (Friend and Moench, 2013).

This research views cities and neighbourhoods as complex adaptive systems. The word 'adaptive' provides an emphasis on conditions that allow complex systems and their relationships to co-evolve over time in response to dynamic interplays between systems, their internal component parts and external systems that might influence them. For example, a city may be affected by a failed crop, which lowers the overall availability of a grain. Market systems inside the city may see grain prices increase due to reduced availability in external supply chains in a nearby region. For an individual within the city the increase in the price of grain in the market may affect other component parts of a person's life; access to healthcare for example, may become prohibitive because a greater part of the salary goes toward food costs, reducing amounts that can be spent elsewhere.

Conceptualising a city and its neighbourhoods through a CAS lens fits the complex reality of urban life. It provides a focus on complexity (Bar-Yam, 1997b), process (Folke, 2006) and scale (Juarrero, 2000). Complex systems have a high degree of order, despite appearing chaotic; they are non-linear and highly complex; dynamic in nature; and interdependent (Bar-Yam, 1997b; Gunderson and Holling, 2002; Gunderson, 2010). They have feedback loops triggered by bottom-up and top-down causations (Juarrero, 2000) and internal and external shocks and stresses. Complex systems have fuzzy boundaries that make it difficult to demarcate where one stops and another systems starts.

CAS processes are analysed through the ways in which heterogeneous individual component parts interact (Levin, 1998) as a loosely formed group that self-organises even in the absence of a 'global' or overall controller (Arthur, Durlauf and Lane, 1997), meaning that each component part interacts with other component parts to produce emergent behaviour, much in the way flocks of birds move, bees swarm or a crowd leaves a stadium (Cleveland, 2005). The processes within CAS are non-linear; systems are made up of autonomous agents that make choices that influence and limit each other (Cleveland, 2005).

Friend and Moench write that examination of urban processes is important because they are often, 'dependent on complex infrastructure, energy, food, water, transport, communications and accompanying socio-cultural systems' and are vulnerable to a range of shocks and stresses (2013, p.103). Processes in a city can be interrupted by natural disturbances, which are slow such as drought or rapid, such as a flood, but are part of a process of disruption, renewal, growth or decline (Cleveland, 2005). Disturbances also provide an opportunity for a system to demonstrate its adaptive capacity, a requirement for evolution and development (Folke, 2006; Martin-Breen and Anderies, 2011). In other words, CAS processes are a part of urban transformation.

While CAS theory provides the opportunity to recognise interdependencies and to study the processes that emerge from them, it has been critiqued for diminishing the importance of the individual (Bar-Yam, 1997b) in order to focus on component parts or a system as a whole. Friend and Moench (2013) write that systems theory does not address social value sets such as equity, poverty and justice and therefore must be supplemented with other relevant theories to account for agency and power in human systems. Arup International Development, an organisation that provides technical expertise to humanitarian and development work, and the Rockefeller Foundation (originators of the 100 Resilient Cities initiative) counter this argument based on collaborative research that recognises the city as a 'system of systems', which includes 'systems that determine human behaviour' such as social, governance and economic systems (da Silva, 2014). In summary, economic, governance and social CAS can be useful for determining who benefits and who is disadvantaged when changes within a system occur.

There are many typologies of scale within CAS, such as a family, a tribe, a neighbourhood, a corporation, or a nation state. Even all of civilisation can be viewed as a complex system (Bar-Yam, 1997b). A CAS is composed of many elements or sub-systems that interact at multiple scales and operate as a whole, giving rise to what is known as emergent behaviour (Bar-Yam, 1997b). Emergent behaviour is the result of the relationships between individual parts and how those behaviours merge together and appear as one (Fiksel, 2006). Emergent behaviour that is self-organised without a preplanned result is a key characteristic of complex systems (Walker et al., 2004; Levin, 1998). Due to the unpredictable element of human behaviour, it is challenging to predict or control a complex system (Bar-Yam, 1997b). Bar-Yam (1997b) observes that hierarchical structures are increasingly being replaced with flatter structures due to individual empowerment from technological shifts such as the industrial revolution

and the current information revolution, arguing that, in large parts of the world, individuals are now empowered to act more independently while engaging with more layers of collective behaviour through networking, organisations and institutions, thus increasing complexity.

Urban Morphology

The second approach discussed in this section is urban morphology. Broadly defined, urban morphology is the study of how urban form is shaped by social, political and economic factors (Whitehand, 2012). Urban morphology engages with history, seeking to draw connections between historical and modern day transformations at different scales and resolutions of urban form in order to identify underlying factors that shape a place (Warner and Whittemore, 2012). The primary concern of urban morphology is the study of urban form; understanding the creation of form is essential to the success of future molding and reshaping of it, making morphology essential to urbanism and urban design (Kropf, 2005). Karaman argues that 'the morphological patterns of cities are as important as economical, social, political, and cultural factors' (Karaman, 2001, p.1).

Interpretation of physical form historically comes from a long chain of different disciplines, including architecture, urban design and planning, geography, history, archeology and social anthropology, each of which emphasises different perspectives (Gauthiez, 2004). Research on urban form is not based in one discipline, rather it is scattered across a range of disciplinary, linguistic and cultural backgrounds (Gauthier and Gilliland, 2006).

There are various schools of thought that have defined urban morphology. In the late eighteenth and nineteenth centuries Durand and Quatremere de Quincy from the French school and Stubben, Geisler and Keyser from the German school focused on identifying architectural types of buildings (Gauthiez, 2004). Meanwhile, at the same time Fritz in Germany focused

on the value town plans had in understanding historical transformations (Gauthiez, 2004). However, it was Muratori and Caniggia from Italy and Conzen, a German geographer, who gave prominence to the value of analysing architectural types and town plans together in the mid-twentieth century (Gauthiez, 2004). This same combination of theory was then introduced again in 1998 by Kropf as a tool for urban designers and planners, and further developed by Whitehand (1987), Moudon (1997), Butina Watson (2007) and others.

Moudon argues that form, resolution and time comprise the three fundamental pillars of urban morphological research, all of which can be used as an interdisciplinary approach to analysis of the city (Moudon, 1997). Urban form is often described in the literature as some variance of the following categories: buildings; plots and lots; open space; streets and movement networks; and topography (Moudon, 1997), depending on the aims and scale of the research (Levy, 1999). These components can be viewed as urban form layers at different scales of resolution. For example, the building layer is the smallest scale of resolution followed by plots and lots then open spaces and movement networks, going out to the largest scale, which is topography and its natural landscape components (Whitehand, 2001; Kropf, 2005; Kostof, 1991).

Analysing scale is important because form is produced and managed at different scales. The examination of scales reveals different degrees of control and power (Massey, 1993). Who is included at different scales is as important as how they are included because it reflects power (Kesby, 2005). Furthermore, scale recognises that a 'place', such as a neighbourhood or a city, is constructed by a range of social relations within a wider geographical context. A place is influenced by the internal processes of relationships between people on the one hand, and between people and their environment on the other. Scale reveals that places have no single identity and are full of internal conflicts (Massey, 1991).

Time is also important because it offers cultural context to the influences on different forms at different scales as they transform over time. Butina Watson and Bentley (2007) observe that up until the nineteenth century, transport limitations in the UK meant that, mostly, buildings were constructed by local materials; however, by the middle of the nineteenth century, industrialisation led to urbanisation, providing access to new channels for sourcing building materials through relatively cheap transportation means. Changes in maps and town plans over time show that different scales of morphology change at different rates. Combining and coordinating analysis of scale and time is aimed at achieving a better understanding of human settlements (Kropf, 2009). Analysis of scale, power and social relations is particularly important for research in low-income settlements where people live on marginalised land, are often socially excluded and therefore are more vulnerable (Dovey and King, 2011).

Having explained why CAS and urban morphology are appropriate approaches for analysing the city and how each approach can be employed, the next section will analyse the city in relation to risks, vulnerabilities and capacities related to urban form, economic, governance and social systems.

2.1.3 Urban form and risk

This section explains the ways in which spatial inequality creates risk in urban form over time. It focuses on risks associated with limited access to adequate housing and basic services.

In 1948 the right to housing was included in the United Nations Universal Declaration of Human Rights and reaffirmed again in the 1966 International Covenant on Economic, Social and Cultural Rights by the Office for High Commission for Human Rights (Habitat III, 2015b). UN-

Habitat (2015b) notes that the right to adequate housing is defined by seven key conditions, many of which are not met in informal settlements and slums, leading to greater vulnerability. The first condition is tenure and security to protect against threats such as forced evictions. The second is access to adequate services such as electricity, safe drinking water, sanitation and refuse disposal. Third and fourth are the conditions of affordable and habitable housing, which encompasses physical safety at affordable costs. Fifth and sixth are the accessibility and location of housing, which are meant to underscore the importance of housing that meets the needs of people with disability and that housing is located in places with employment opportunities, health care centres, schools and other social services. The final condition is cultural adequacy, which reinforces that housing respect the expression of culture and identity. While urbanisation offers the opportunity to meet these conditions, poor governance fuels inequality and disaster risk in many low and middle-income countries (McClellan, 2010).

The housing needs of poorer urban people are met in diverse ways that often do not satisfy the criteria listed above. Many find accommodation by building or buying homes in illegal settlements, while others rent in a tenement building, a inexpensive boarding house or in an illegal development (Hardoy and Satterthwaite, 1989). Some sleep in public spaces such as graveyards or railway stations, paying gangs or local officials to stay there (Hardoy and Satterthwaite, 1989). UN-Habitat defines 'informal settlement' or 'squatter settlement' as lacking security of tenure of land or housing; as neighbourhoods without basic services such as power, sanitation, electricity and refuse collection; and as housing that does not comply with planning and building regulations (Habitat III, 2015e). Meanwhile, 'slums' are often characterised by conditions of depravity and exclusion (Habitat III, 2015e). Dovey and King write that 'a squatter lacks land tenure; a slum variously lacks space, durability, water and sanitation; informality implies a lack of formal control over planning,

design and construction' (2011, p.12). However, terms like 'informal', 'squatter' and 'slum' are problematic because of negative connotations that frame people in terms of what they lack. Therefore the more neutral word 'settlement' will be used throughout the research.

For poorer urban people, proximity of housing to the location where one can earn money is often a priority over the size and quality of housing (Hardoy and Satterthwaite, 1989). Therefore situations of overcrowding in settlements can become an issue. To this end, health and hygiene risks increase where access to water and sanitation is lacking and the risk of diseases such as diarrhea, dysentery and acute respiratory infection grows. Children in settlements are particularly vulnerable to health risks due to environmental decay (UNICEF UK, 2013). Satterthwaite (1989) notes that when people have to cut the costs of living, many usually sacrifice on their environment and live in places that are unsafe due to factors such as pollution, overpopulation, frequent flooding and/or landslides.

When natural hazards such as floods or cyclones strike, poorer urban people are almost always significantly more exposed and vulnerable because of housing with poor construction, design, workmanship and low-quality building materials (Kyazze, Baizan and Carpenter, 2012). Moreover, they are prone to receiving less housing assistance due to informal tenure (McCallin and Scherer, 2015) because they are out of the formal system. The British Red Cross (2012) notes that reconstruction of settlement housing after a disaster can be further complicated by contested land ownership, high costs of land, risks of reconstructing in the same hazardous environmental locations and in areas that lack access to services. To overcome challenges related to housing and access to basic services, different settlement upgrading approaches have been employed over the years. The next section analyses key approaches to low-income housing provision.

Settlement and 'slum' upgrading

Various approaches to settlement and 'slum upgrading' have been taken over the years. The 1950s and 1960s established a trend of demolition of settlements in the search for a 'new Utopia' through standardization and mass production of housing, an approach that was intended to improve living conditions by removing obstacles to 'modernisation' (Hamdi, 2010), as was described earlier in this chapter concerning development theory. However, this approach was socially disruptive (Abbott, 2002), and was subsequently replaced in the 1970s by a 'sites and services' approach where urban lots were provided for people to incrementally build their own homes (Jaitman and Brakarz, 2013). Instead of removing settlements, governments focused on the provision of 'in land regularisation, infrastructure planning, security of tenure, self-build opportunity and credit provision' (Hamdi, 2010, p.3). Turner's (1976) approach to housing highly influenced thinking about shelter, with Turner's observation that, for many, housing should be treated 'as a verb' (i.e it is what a house does for the owner that matters, such as providing income earning opportunities), and also that housing can serve as an intergenerational asset (Sanderson, 2009a).

However, the sites and services method was perceived to have failed by some because it displaced people from the city centre and their jobs to the periphery; banks were uninterested in providing loans to poorer people who were not guaranteed to repay debt; programmes were often taken over by less poor people; and governments needed to continue to pay large subsidies for land and infrastructure, which was not an affordable long-term solution (Hamdi, 2010).

Building largely on Turner's thinking, in the 1980s an in-situ upgrading approach took hold where low-income neighbourhoods were better

integrated into cities through social and economic strategies such as networks and savings groups in addition to physical upgrading. Some new homes were built, but the primary focus was on 'upgrading' existing housing stock through 'integrated development projects' that offered loans to improve housing, sanitation, electricity, sewerage and streets (Hamdi and Geothert, 1997). Legalisation of land tenure was also a key area of focus (Hamdi, 2010). In Thailand, and in many other countries, upgrading was dominated by different ministries, local authorities and government agencies, many of which had siloed approaches to dealing with the interconnected aspects of a poor neighbourhood, failing to address root causes of everyday and disaster risk (Boonyabancha, 2009).

In-situ upgrading is most noted for its success in places where governments have made political commitments to large-scale upgrading programmes 'in parallel with legal and regulatory reforms in land policy and land regularization' (Jaitman and Brakarz, 2013, p.5) and where poorer people have worked collectively to tackle their own poverty and exclusion (Boonyabancha, Carcellar and Kerr, 2012). Currently upgrading approaches on the whole promote tenure legalisation and in-situ upgrading with a focus on participation between settlement dwellers, institutions and governments and incremental change (Hamdi, 2010).

In summary, looking at the different aspects of urban form demonstrates that settlements are often spatially segregated from the wider-city and are excluded from conditions that protect people from everyday and disaster risk, but that there are ways to address housing and services challenges. The next section analyses the city from a CAS perspective, looking specifically at economic, governance and social CAS. These systems have been chosen to compliment the urban form analysis in this section.

2.1.4 Economic complex adaptive systems

Economic CAS are defined as systems that provide economic benefits such as money, markets, businesses, rent, jobs, savings, loans, credit, ownership and skills. Different economic CAS operate throughout the city at different scales. For example, imports and exports at a national level impact the local level; the health of the global financial market impacts the health of a city's local markets and the way in which economic forces affect an individual's ability to carry out small-scale trade. Cities thrive on commerce, cash and competition driven by global, regional and local forces; therefore access to key economic systems such as markets, jobs, savings, loans, credit, land ownership or skills that enable participation in different economic systems is crucial for people. For poorer people, access to economic capital is one of the most effective tools to escape poverty (Moser, 2006). The British Red Cross (2012) states that after a disaster, some of the key economic challenges faced by poorer urban people include inadequate or unstable income, high levels of unemployment, the need for cash to meet basic needs and the lack of skills necessary to survive in a market economy. De Soto (2000) argues that turning informality into formality would allow poorer people to convert informal savings and investments in housing and businesses into meaningful ways to generate capital. Having explained what an economic CAS is, the next section will focus on the opportunities and challenges for specific components of economic CAS, including land, markets and microfinance.

Land

When land rights are adequately documented land can be turned into capital to be used as a loan, as investment or traded within broad circles (de Soto, 2000). A report on the impact of displacement after disaster by the Internal Displacement Monitoring Centre (IDMC) found that housing responses tended to favour people with secure tenure to the exclusion of people living in settlements, including tenants (McCallin and Scherer, 2015). To this end, lack of access to land tenure can make people more vulnerable. While more work is required to understand how the

humanitarian sector can better provide support to different degrees of land ownership and access after a disaster, some examples include land pooling and re-allocation (Dodman et al., 2013); working with land owners or municipalities on strengthening tenure; regularising informal settlements, acquiring private land or allocating public plots for housing (McCallin and Scherer, 2015). Such measures require cooperation between multiple stakeholders including the government, development and humanitarian partners.

Cash, markets and employment

Poorer people generally have unstable or inadequate income before a disaster strikes. To this end, access to cash, markets and some form of employment is crucial to meet basic needs. In a review of evidence of what works in urban disaster recovery, Sanderson and Knox Clarke (2012), found that cash transfer programmes (an alternative to in-kind distribution where people are given money instead of goods) can meet immediate and recovery needs after a disaster, and may in fact be preferable to cash for work (Harvey and Bailey, 2015). Cash programming is increasingly being used in humanitarian response in urban settings (as well as elsewhere) (Sanderson and Willison, 2014; Clermont et al., 2011) as 'the default setting' due to the fact that people in cities rely on cash to meet their basic needs, thereby increasing reliance on local markets (Kyazze, Baizan and Carpenter, 2012). The Cash and Learning Partnership (CaLP) organisation writes that cash programming in urban disaster environments aims to 'improve speed, appropriateness, and efficiency in humanitarian programmes', pointing out that cash responses tend to build the resilience of markets while capitalising on different states of urban connectivity (Cross and Johnston, 2011, p.vi). After a disaster, rebuilding livelihoods requires integration in the urban economy, working with market systems and the private sector to identify employment opportunities and microfinance institutions that can support recovery (Grunewald et al., 2011).

Microfinance

Microfinance, in the sense of providing formal lending services to poorer people through microcredit schemes, was made popular in the early 1970s (Hossain, Rees and Knight Millar, 2012) by pioneers such as the Grameen Bank, Self Employed Women's Association (SEWA) in India and Accion International in Latin America (Sundaresan, 2008). Microfinance later included other services such as savings and insurance (Roodman, 2012). Between the 1980s-1990s NGOs and non-bank financial institutions set up their own microfinance models as 'group lending' and 'self-help groups' (Sundaresan, 2008). Yunnus, a pioneer of microfinance and founder of Bangladesh's Grameen Bank writes that microfinance is 'not a miracle cure that can eliminate poverty in one fell swoop. But it can end poverty for many and reduce its severity for others (Yunnus, 2003, p.171).

Microfinance is most effective when paired with access to education, health care and advances to technology such as mobile phones and biometrics (Yunnus, 2003). It has also been an effective tool to empower women to expand their financial asset bases (Moser, 2006). Microfinance in groups can alleviate livelihood shocks and reduce chronic poverty stresses (Devereux, 2002) through providing means to purchase or replace tools such as food carts, which may have been destroyed in a disaster. Moreover, collective action through activities such as group lending can contribute to the creation of positive social capital (the networks and quality of relationship people have with each other (Woolcock and Narayan, 2000)) such as when people build higher levels of trust between members of the lending groups.

Having explained the ways in which economic systems interact to create risks and opportunities for poorer people living in cities, the next section

will analyse governance systems for managing institutions and policies in urban areas.

2.1.5 Governance complex adaptive systems

Governance CAS involve the organisation of power and decision-making by entities such as civil society, the government, institutions, leaders and networks through frameworks such as planning policies and legal systems (Resilience Alliance, 2007). Governance concerns the management of a country's affairs at all levels. It includes the mechanisms, decision-making processes and institutions that mediate the interest of governments, civil society, the private sector and all other relevant groups within the rule of law (UNDP, 2010). Governance includes, 'formal and explicit mechanisms such as legislation, policies, mandatory standards and administrative procedures through which societies are organized as well as the wide range of informal and implicit arrangements that mediate social, economic and political relationships and the management of territory and resources' (UNISDR, 2005a). A key point to note is that governance is broader than government; it includes the interaction between formal institutions and civil society (de Haan, 2009).

Good governance

In the aid sector 'good governance' dominates the literature, specifically in terms of defining what good governance means (Botchway, 2000). Good governance is understood to include institutional processes that are transparent, free of corruption, accountable, inclusive, efficient and follow the rule of law (UNESCAP, 2013; Maldonado, 2010; Weiss, 2000). Pelling (2011b) notes that good governance includes a strong civil society and collaboration while Uddin (2013) emphasises the importance of decentralised and devolved decision-making systems. Wide stakeholder engagement at a variety of levels is also crucial in disaster governance (Gall, Cutter and Nguyen, 2014), however coordinating decisions and activities between a wide spectrum of stakeholders is a particular

challenge (Grunewald et al., 2011) alongside working with governments who often lack authority, capacity and knowledge (Brown et al., 2015).

Exclusion from decision-making

Sanderson and Knox Clarke note that 'Many urban residents, especially those living in informal settlements, are largely excluded from formal governance processes and services' and furthermore, that informal settlements have a distrust of public-private partnership and the potential influence on planning priorities and agendas (2012, p.14). Exclusion from such processes can hinder a sense of ownership in disaster recovery processes, which is necessary for achieving sustainability, resilience and long-term effectiveness of activities in the recovery (Sanderson and Knox Clarke, 2012).

Urban laws and planning

As stated earlier, governance also includes urban law, defined by Habitat III as a collection of 'policies, laws, decisions and practices that govern the management and development of the urban environment' (Habitat III, 2015d, p.1). When laws or policies are ineffective or are an inappropriate reflection of the realities on the ground, informality grows, denying large parts of society the opportunity to participate in a range of social, economic and political decision-making processes (Habitat III, 2015d).

Moreover, few national and international disaster management agencies work with urban governments and communities to identify and act upon the urban processes that are a source of disaster risk (Bull-Kamanga et al., 2003). The IFRC's 2015 World Disasters Report on local actors notes that supporting coordination of decision-making regarding disaster risk management (DRM) across diverse governance stakeholders is an effective way for agencies to engage with urban governance. The report states, 'when it is well done, mainstreaming disaster risk reduction into development planning is a sustainable method to improve resilience and

reduce vulnerability in a country' between local actors (Hamza, 2015, p.54). To address the challenges of informality, rising inequality and disaster risk, a DFID funded report entitled, Future Proofing Cities suggests coordination is required across 'infrastructure, engineering, environment, planning, design, economics, and social science professions to help cities develop solutions at the nexus between urban planning, transport, water, energy, waste, agriculture, ecosystems, and design and architecture (Allen et al., 2012, p.9). Having explained the conceptualisation of governance CAS, the next section presents key challenges and opportunities within social CAS.

2.1.6 Social complex adaptive systems

Social CAS are defined by social interaction such as networks, social capital, discrimination, culture and values. Social CAS also includes social services such as education, welfare and healthcare (Resilience Alliance, 2007). This section analyses the ways in which networks, partnerships, participation, social capital and social services provide opportunities and challenges for poorer people living in cities.

Networks

Boonyabanha *et al.* (2012) observe that networks are the 'greatest force' for tackling poverty and exclusion when they are comprised of people who experience poverty and exclusion themselves, reasoning that such people have the greatest motivation to change their situation. Networks can have a cross-scalar function at a neighbourhood, city and national level as seen by the Asian Cities Climate Change Resilience Network (ACCCRN) and Baan Mankong in Thailand (Boonyabanha, 2005) or at a global level as seen in UNISDR's Making Cities Resilient Campaign (Johnson and Blackburn, 2014). They can create space for new collaborations (Boonyabanha, Carcellar and Kerr, 2012) to address everyday risks and disaster shocks. ACCCRN's work on city resilience in Asia highlighted that when networks include policy and advocacy work at national levels of governance there is a

greater chance of influencing and shaping change at a state level (Bahadur and Tanner, 2014). Networks empower poorer people in cities to negotiate access to land, loans and public utilities as well as policy change for housing regulations that better suit their context, for example by permitting houses to be built closer together. Balances of power are shifted when networks of people form and work together in the absence of possessing monetary wealth. Moreover, networks build social relationships between people, creating the potential for societal transformation.

Partnerships

Partnerships, also known as ways of working together for mutual gain, are particularly important ways of collaborating to achieve 'a common goal [that] can be reached by satisfying partner needs while sharing risks and rewards along the way (Rein et al., 2005, p.3). Partnership models draw on development thinking and other disciplines to understand the different ways in which people work together. Multi-sectoral partnerships in urban areas are crucial within a city due to the centralisation of services such as water and the subsequent multiple levels of accountability that is required for such services to run reliably and effectively (Reed, 2007).

Sanderson and Knox Clarke (2012) write that in an urban disaster the scale and complexity of immediate assistance and long-term recovery increases the need to work in partnerships, and that the most effective partnerships are likely to be those established ahead of a disaster. However, for some, partnership is an idealised concept. Hamdi observes that partnership is 'one of those motherhood words incorporating everything good and desirable – mutual respect, accountability, transparency, shared values, shared objectives and the mutual pursuit of ends and means' (2004, p.29). Principles of partnership is an important component of humanitarian response (Hancock, 2009) that can assist with grounding the desirable in clearly defined reality by using contracts, for example.

The asymmetry of participation

Much like partnership, participation is a concept that suggests inclusiveness and mutual opportunity to contribute to an agreed upon goal, however it suffers from similar critiques as partnership does in relation to the sharing of power. The World Bank defines participation as 'A process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them' (World Bank, 2007, p.3). Moser defines 'genuine' participation as 'an inevitable sharing and then transfer of power involved as social groups deliberately attempt to control their own lives and improve their living conditions' (1983, p.4). Definitions that discuss power in relation to participation stem from the belief that economic and social policies and institutions (including formal and informal) determine who participates and who does not (Moser, 1995). Guimaraes (2009) observes that participation is strongly influenced by cultural understandings of roles and responsibilities; social norms; and the presence or absence of governance structures that promote positive participation.

Participation of poorer people in decision-making in the city can be difficult due to the heterogeneity of urban 'communities' (Bahadur and Tanner, 2014). Pimbert and Pretty (1997) write that there are seven types of participation, including: passive participation, participation in information giving, participation by consultation, participation for material incentives, functional participation, interactive participation and self mobilisation. Linked to participation, is the notion of two-way communication between people who provide aid and recipients of aid. Anderson *et al.*'s Time to Listen project interviewed 6,000 people who have received or given international aid from across the world, and found

among other things, that there was an 'information gap at every phase of international assistance' (2012, p.114). The project also concluded that aid recipients wanted to know more about recipient selection criteria, project objectives and timeframes and funding information' in order to not feel 'sidelined', 'suspicious' or 'disappointed' (Anderson, Brown and Jean, 2012, p.114).

Social capital

Social capital operates as one of many sub-systems within the larger system of social dynamics, and can be described as the ability to accrue resources through membership in social groups that take collective action guided by specific social norms (Portes and Landolt, 2000). Aldrich (2012) argues that high levels of social capital are at the core of disaster recovery. Scholarship identifies many typologies of social capital, but amongst some of the most common are three types: bonding, bridging and linking. Bonding social capital is identified by forms of reciprocity and solidarity between homogenous groups of people (Putnam, 2000) such as family members, friends or neighbours (Woolcock and Narayan, 2000). Bonding is comprised of horizontal or 'intra' bonds that tie together similar individuals (Archer, 2009). In times of stress, such groups cope by giving members short-term access to socio-economic support (Pelling, 2003). Meanwhile, bridging social capital occurs when a homogenous core group inter-relates with external groups that maintain the same horizontal status, but are from different organisations, locations and identities (Aldrich, 2012). Finally, linking capital can be defined as the vertical links between different power gradients and hierarchy structures (Lin, 1999). Archer (2009) observes that social capital is most valuable when horizontal and vertical levels of interaction are promoted.

Social services: health care, education and cultural rights

The protection and promotion of access to social services such as education, health care and cultural rights is another aspect of good

development. However, when a disaster strikes oftentimes such development gains can be set back (i.e. years of investment in social, economic, physical, and political development interventions). Access to health care in a disaster is crucial but it is likely for hospitals and clinics to be damaged, and the ability to provide adequate service impeded due to disruptions in the supply of power, medicine and human resources as well as an increase in patient case loads (Brown et al., 2015). The Inter-Agency Standing Committee's (IASC) Operational Guidelines on Human Rights and Natural Disasters (2006) states that measures should be taken to ensure the return of children to education as quickly as possible without cost in order to ensure children from families that can no longer afford schooling are able to continue with their education. The guidelines also state that a freedom of expression, association and religion should be respected when planning humanitarian assistance and recovery in order to avoid discrimination (Inter-Agency Standing Committee, 2006). Belief systems within different cultures shape how people view disaster risk, therefore understanding the variations of cultures in a city or a neighbourhood can assist governments and other urban actors on how to communicate disaster risk (Cannon and Schipper, 2014).

Having described key development theories that influenced the growth of urban centres, the ways in which cities can be conceptualised through CAS and urban morphology approaches, and the types of risks and opportunities that exist within the urban form and economic, governance and social systems, the next section of this chapter presents analysis of key disaster theories and approaches.

2.2 Disaster

This section aims to explain key disaster theories that provide an understanding of vulnerability and capacity in relation to urban areas. It begins with an explanation of two key theories that illustrate the cause of

a disaster – the Pressure and Release Model and the disaster management cycle. It then explains key attempts to link disaster and development paradigms before it closes with an explanation of disaster risk reductions measures that were put in place to mitigate and prevent disaster risk.

2.2.1 Explaining disaster

Pressure and release model

The Pressure and Release Model (PRA), also often referred to as the crunch model, developed by Wisner *et al.* (2004), describes disaster in terms of vulnerability meeting a hazard. Vulnerability can be described as susceptibility to damage or injury. Wisner *et al.* define it as, ‘the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard (2004, p.11). Moreover, Cannon (2008) argues that for vulnerability to be useful as a concept it must be predictive. Meanwhile, a natural hazard can be defined as aspects of the physical environment that cause harm such as an earthquake, flooding, drought and landslide (Collins, 2009).

The PAR model is illustrated below in Figure 2.2.1a. The first box on the left identifies root causes of risk such as social, economic, cultural, social and political processes that create vulnerability (for example neoliberalism). Dynamic pressures, indicated in the second box from the left, channel root causes into processes such as rapid urbanisation. The third box from the left identifies unsafe conditions, which are factors that make an environment dangerous for people, for example having to work in hazardous conditions such as a mine. Wisner *et al.* (2004) explain that together, the three boxes on the left create a progression of vulnerability. The diagram in Figure 2.2.1a bellows illustrates that when vulnerability meets a hazard, disaster occurs. Twigg defines a disaster as, ‘What occurs when the impact of a hazard on a section of society (causing death, injury,

loss of property or economic losses) overwhelms that society's ability to cope' (2004, p.13).

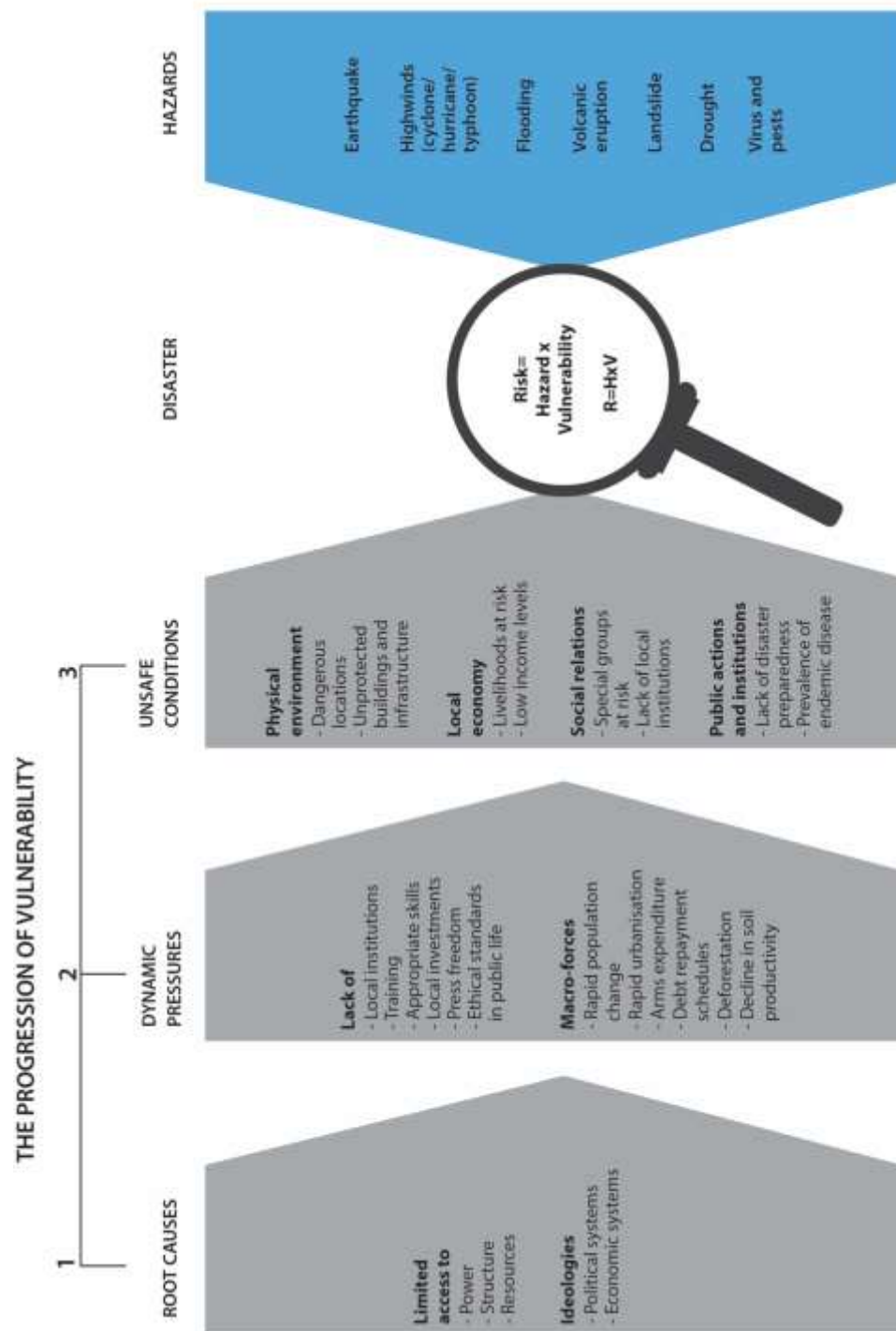


Figure 2.2.1a: An interpretation of the Pressure and Release Model from (Wisner et al., 2004), which illustrates that a disaster occurs when vulnerability meets a hazard. Source: the author

A version of the pressure aspect of the PAR model is often given in the formulaic representation: Disaster = hazard x vulnerability (Wisner *et al.*, 2004), where the multiplier implies that both elements, hazard (the natural phenomenon) and vulnerability need to be present for a disaster to occur.

Disaster management cycle

Another way to understand the progression of disaster related vulnerability in terms of time is through the disaster management cycle. While there are different representations of the cycle, the focus of disaster management is on three key stages: before, during and after a disaster, commonly articulated through the categories of mitigation and preparedness (before); the disaster itself (during); and relief, recovery and rehabilitation (afterwards) (Collins, 2009). Preparedness consists of measures taken before a disaster that reduce disaster risk (Twigg, 2004). Early warning, a form of preparedness, is when a disaster is forecasted ahead of time and those who will be affected are warned (Collins, 2009). Mitigation is when actions are taken to reduce the scale of, or even prevent, a disaster from occurring (Sanderson, 2009b). Examples include structural measures such as building flood dams and non-structural measures such as public education (Twigg, 2004). Relief, as defined by IFRC, is when 'goods and services [are] provided to meet the immediate needs of disaster affected communities' (IFRC, 2007a, p.8). Meanwhile, recovery is understood as rebuilding and adapting physical, natural, social, and economic aspects of a society in order to better withstand future risks (Smith and Wenger, 2007). Lastly, rehabilitation is about using development approaches to deal with the longer-term effects of the disaster (Collins, 2009).

Collins highlights that the disaster management cycle includes disaster prevention, noting: 'the right type of development' can prevent a disaster and that a response to a disaster can 'be part of the prevention of future

disasters' (Collins, 2009, p.28). However, there are critiques of the model. In a study of 22 UK-based relief and development NGOs running disaster risk reduction initiatives, Benson *et al.* (2002) found that in reality there is no clear continuum of stages in disaster management, that disaster recovery is not linear, and that aid agencies (agencies that receive money from donors to conduct relief or development activities) often find themselves conducting emergency programming within long-term development projects and *visa versa*. DFID (2004) also critiqued the cycle noting that it does not reflect successful preparedness and prevention activities that avoid a disaster occurring. Additionally, the cycle infers that after a disaster, things go back to 'normal' when 'normal' is what may have resulted in the kind of vulnerability that enabled the disaster in the first place (Sanderson, 2009a).

Having explained the origins of disasters through the PAR model and the disaster management cycle, the next section will focus on theories and models that link disasters and development.

2.2.2 Linking disaster and development

This section introduces key approaches that link disasters and development thinking, including the linking relief, rehabilitation and development (LRRD) approach; the access model; capacities and vulnerabilities assessment; livelihoods approaches and disaster risk reduction.

Linking relief, rehabilitation and development

Traditionally links between short-term humanitarian assistance and longer-term development interventions have been difficult to operationalise, therefore the concept of linking relief, rehabilitation and development arose, but has been put into practice in a limited manner (Mosel and Levine, 2014). LRRD attempts to reconcile short-term objectives of saving lives with longer-term development objectives of

reducing vulnerability and poverty, and considers the type of aid provided within each area. To address the challenge of working in silos it was argued that 'Better 'development' can reduce the need for emergency relief; better 'relief' can contribute to development; and better 'rehabilitation' can ease the transition between the two' (Buchanan-Smith and Maxwell, 1994, p.2).

LRRD derives from the African food crisis in the mid to late 1980s (Buchanan-Smith and Fabbri, 2005) but grew into a larger discussion in the 1990s (Mosel and Levine, 2014) when it was used to address what are now called complex emergencies, defined broadly as when total or considerable breakdown of authority has occurred and an international response is required (IFRC, 2015). Then, as now, the humanitarian sector was faced with an increase in disasters setting back development gains, and had the need to do more with less. However, there were several problems with LRRD. Firstly, there was no agreed upon definition of the relief, rehabilitation and development components of this approach, including when they start and when they end (Otto and Weingärtner, 2013). Nor was it a process driven by consultation with disaster-affected people; it was about defining the type of aid that was required at different stages and the types of solutions to the gray zone (the stage between relief and development) (Buchanan-Smith and Fabbri, 2005). Moreover, LRRD is critiqued for focusing on a one-way continuum: linking relief with development and neglecting the importance of a contiguuum, which would imply movement in both directions (Harmer and Macrae, 2004).

Yet, Mosel and Levine (2014) argue that many people see resilience as the best opportunity yet to achieve progress on LRRD by bringing together relief and development thinking. Otto and Weingartner (2013) write that resilience may be able to achieve an entry point for integrated programming, an aspect of LRRD that was unclear.

Having explained the key components of LRRD, the next section discusses the strengths and weaknesses of the access model's ability to link relief and development.

Access model

The access model expands on the PAR model by focusing on the economic, political, and social processes that impact people's vulnerability and exposure to physical hazards (Wisner et al., 2004). It is designed to understand complex and varied processes that are associated with the creation of unsafe conditions resulting from 'economic and political processes that allocate assets, income and other resources in a society' (Wisner et al., 2004, p.92). Sanderson (2009a) notes the linear flow chart model emphasises the nature of livelihood strategies in vulnerability reduction and capacity building through the interplay of concepts such as 'household', 'assets', 'the flow of power' and 'social relations'.

A household is defined by people who 'live and eat' under the same roof (Rakodi, 2002, p.7). Assets are defined an asset as a 'stock of financial, human, natural or social resources that can be acquired, developed, improved and transferred across generations' (Ford Foundation, 2004, p.9). An increase in five types of assets (physical, human, natural, financial and environmental), which Moser (1998) calls 'capital' reduces people's vulnerability. A decrease in assets results in greater household insecurity (Moser 1998). The Access Model analyses people's access to assets, which is controlled through power and social relations. Sanderson (2009a) notes that the model was not adopted widely when it was developed in the 1990s, perhaps due to the popularity of the livelihoods model at the time.

Capacities and vulnerabilities analysis

The capacities and vulnerabilities analysis (CVA) by Anderson and Woodrow (1998) also explores the relationships between disasters and development. It is an assessment tool developed as a way for

developmental priorities to be maintained while responding to disasters. Shared by both development and disaster practitioners alike, Anderson and Woodrow (1998) enable the classification of complex interactions through the use of a simple matrix that services as a tool for identifying vulnerabilities and capacities within three categories. The first is the ‘physical/material’ category that analyses the productive resources and skills that exist within a community. The second is the ‘social/organisational’ category, which explores the types of relationships and societal structures that organise people. The third is the ‘motivational/attitudinal’ category that seeks information about how the community views its ability to create change. Figure 2.2.2 below shows the CVA tool and its respective categories.

	Vulnerabilities	Capacities
<p>Physical / material What productive resources, skills and hazards exist?</p>		
<p>Social / organisational What are the relations and organisation among people?</p>		
<p>Motivational /attitudinal How does the community view its ability to create change?</p>		

Figure 2.2.2a: Anderson and Woodrow’s (1998) CVA tool as interpreted by the author. Source: the author

The tool has many strengths, including its ease of use (Sanderson, 2009a); its recognition of the physical and non-physical, including livelihoods (which would fall into the physical/material category) (Twigg, 2004); and its acknowledgment of capacity as an aspect of vulnerability, thereby

valuing the skills and abilities disaster-affected people have to cope and recover from a crisis (Sanderson and Sharma, 2008). Although it has been critiqued for not including the hazard, which could change the types of capacities and vulnerabilities that exist (Twigg, 2001).

Livelihoods

The livelihoods approach combines analysis of chronic stress (reoccurring stressors that reduce one's ability to cope) and disaster shocks. Moreover, it places disasters within a wider development frame, which breaks away from traditional approaches to disaster risk reduction that first seek to identify hazards and risk and second identify development links (IFRC, 2004). While the word 'livelihoods' was first made prominent in the 1987 Brundland report, it was Scoones at the UK's Institute of Development Studies (IDS) who developed the first model, which was later made well known by Chambers and Conway, and served as the basis for other livelihood models (Sanderson, 2009b). Chambers and Conway define livelihoods as, '...the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long-term' (1991, p.6).

Chambers and Conway's (1991) definition encompasses three relational areas of capability, equity and sustainability while focusing on shocks (sudden events that impact vulnerability such as floods and fires) and stresses (cumulative and continuous pressures such as rapid urbanisation). Oxfam later developed a model from which Carney (1998) subsequently developed for DFID into a widely used approach. Carney's 1998 model brought together the concepts of vulnerability, assets, access and control. It was widely influential and adopted within a number of international

developmental organisations. Carney's model, as had Oxfam's, highlighted the importance of household level assets. This was depicted as the 'assets pentagon' within the model.

DFID's Infrastructure and Urban Development Division (IUDD) subsequently commissioned the Development Planning Unit (DPU) at University College London (UCL) to develop an urban livelihoods approach, reasoning that rural models do not reflect the 'depth and scale' of urban poverty and that there was an overall lack of urban tools and approaches targeting development and disasters together (Sanderson, 2009a, p.28). Meikle *et al.* (2001) write that while the household is placed at the centre with an emphasis on assets and how they change over time, there are notable differences between Carney's model and the DPU model. From an economic perspective, the DPU model highlights the importance of a cash based economy; socially it underscores the importance of social capital; in governance it emphasises the multiple layers of actors from a local to a national scale; and from an environmental perspective it notes the impact of population density, pollution and hazardous living conditions. Furthermore, Meikle *et al.* (2001) write that in urban areas, assets that are not personally owned are important for reducing vulnerability, for example electricity lines.

There are multiple critiques of the sustainable livelihoods model. By the mid-2000s a number of agencies dropped the model because it was found to be difficult to operationalise, especially for those with sectoral mandates who were unsure how to implement their work in a holistic way as per the model (Sanderson, 2009b). Pinder (2009) notes that the main constraint with the livelihoods approach is that it works at the micro level, making it difficult to scale-up and include things like markets and policy. Other critiques include that it does not lead to conclusions for programme design; lacks analysis of power dimensions (particularly in relation to

gender and social exclusion) and is limited in the evidence it provides that the approach reduces poverty (Pinder, 2009).

Finally, it is worth noting that upon reflection on the differences and similarities between livelihoods and resilience, Sanderson (2009a) highlights that the two concepts share a common foundation. While livelihoods uses household as a unit of measurement, resilience uses communities; livelihoods uses the word 'assets' and phrases like 'coping and recovering from', while resilience uses 'systems' and talks about 'bouncing back' and 'adapting' to future threats. Therefore, Sanderson (2009a) recommended that in the emerging presence of resilience, sustainable livelihoods changes its name to 'resilience and livelihoods' and talk about 'building resilience' instead of increasing assets.

Disaster mitigation and preparedness, and disaster risk reduction

Another concept that attempted to link disasters and development was disaster mitigation and preparedness (DMP), which is observed by Christopolos *et al.* (2001) as a concept that lived in the shadows of humanitarian and development aid because it did not 'save lives' or 'reduce poverty'. DMP is about risk management and is concerned with minimising the effects of disasters while taking precautionary measures to prepare for risk (Christopolos, Liljelund and Mitchell, 2001). However, disaster risk reduction (DRR), which came to the fore in the early 2000s, is the concept more broadly embraced by the aid sector today with its focus on 'policies, strategies and practices to reduce vulnerabilities and disaster risks throughout society' (Twigg, 2015, p.6). DFID defines DRR as 'policies and practices to minimise (with a view to longer-term prevention) disaster losses' (DFID, 2004, p.17). DRR and climate change adaptation (or CCA, which is understood as adjustments to actual or explicit climate events that can cause harm to human and natural systems) are often described as sharing a common focus. UNISDR and UNDP note 'there is little practical difference between the two' and therefore suggest in their report on

Disaster Risk Reduction and Climate Change in the Pacific that opportunities for working together should be sought in order to ease programming duplication, avoid potential policy conflicts and use limited resources wisely (Hay, 2012, p.ii).

Having explained how different approaches to linking disasters and development have manifested throughout the years, the next section will provide analysis of the key debates and discussions within the concept of resilience.

2.3 Resilience

This section comprises a literature review of the theory and practice of resilience. The theory section traces the evolution of resilience and then analyses how the word is defined from three perspectives relevant to this research, namely, socio-ecological, disaster and urban. It then explains the key conceptual debates that highlight the strengths and weaknesses of the word when applied to urban disaster.

The practice of resilience analyses practical debates about operationalising resilience. It then analyses global policies that turn the concept of resilience into practical actions. A review of a selection of operational frameworks is then presented, further investigating how resilience is put into practice in disaster affected communities and neighbourhoods. This section ends with a definition of urban disaster resilience that will be used to frame the research.

2.3.1 Theory of resilience

This section investigates the evolution of resilience. It then analyses the different ways in which resilience can be defined. Key conceptual debates are then presented for analysis.

Evolution of resilience

Resilience can be understood in multiple ways. It was first used in sciences, humanities, political and legal disciplines before it was adopted by social science and sustainability researchers (Alexander, 2013). The word 'resilience' originates from the Latin word 'resilire' or 'resilio' and means 'bounce', which is where the concept of 'bouncing back' appears to have arisen from (Manyena, 2006). Tracing the etymology of resilience, Alexander writes that uses of the word resilience are marred in a history of positive and negative connotations whereby resilience can be understood positively as 'leaping, jumping or rebounding' or be interpreted negatively as 'retracting', 'recoiling', or 'desisting' (2013, p.2708).

Alexander (2013) also notes that resilience was first documented in English in 1625 in relation to natural history, and then again in 1858 in a discussion of robustness in mechanics and later still in the 1950s in psychology, specifically in relation to child psychology, and finally in the 1990s where it reached human ecology and social sciences, specifically in relation to the ways in which people adapt to their environment. However, others challenge this, writing that resilience originates from ecology (Batabyal, 1998; Djalante, Holley and Thomalla, 2011).

While the history of resilience is somewhat contested, what can be said is that Holling's 1973 paper, 'Resilience and Stability of Ecological Systems', gave resilience prominence in relation to systems theory and ecology, which is believed to be the foundation of resilience in social sciences (Adger, 2000). By the 1980s resilience was increasingly used to analyse interactions between humans and the environment (Janssen et al., 2006). In 1999 in the humanitarian action sphere the Resilience Alliance was formed in order to develop an interdisciplinary approach to resilience with some agreed upon core fundamentals (Janssen et al., 2006).

Defining resilience

The qualities emphasised in the concept of resilience vary depending on the discipline from which resilience is defined. Disaster management and socio-ecology have a strong focus on environmental and human interaction, which means an understanding of resilience from a socio-ecological perspective can be helpful.

a.) Socio-ecological resilience

Socio-ecological resilience is when transformation, development and sustainability occur through processes of reorganisation, learning, adapting and building capacity (Bruijne, Boin and van Eeten, 2010). The assumption is that disturbances within systems have the potential to create opportunity for change when control shifts between different variables, transforming relationship dynamics and the power to influence or provoke change (Folke, 2006). Folke states that resilience is ‘...about the opportunities that disturbance opens up in terms of the recombination of evolved structures and processes, renewal of the system and emergence of new trajectories’ (Folke, 2006, p.259).

Holling argues that there are two faces of ecological resilience (2010), and the difference is in the stability aspect. The first is described as a traditional perspective that values single state equilibrium by focusing on ‘efficiency, constancy and predictability – all attributes of a core engineers fail-safe design’ (Holling, 2010, p.53). The second definition is ‘far from any equilibrium steady state’ and focuses on, ‘persistence, change and unpredictability – all attributes embraced and celebrated... by those who search for safe-fail designs’ (Holling, 2010, p.53). This definition measures resilience by how much disturbance a system can manage before the system changes its shape and structure (Holling, 2010). It is the second definition of resilience from which the paradigms of urban and disaster resilience are linked. Disaster and urban resilience paradigms are interested in understanding the characteristics (Twigg, 2009; ARUP, 2011)

of a system that firstly build a system's ability to tolerate stress and secondly that result in positive change when a disturbance takes place (Cutter et al., 2008).

b.) Disaster resilience

Resilience is a theme that ties together disaster and development contexts (Luthar and Cicchetti, 2000). Manyena defines disaster resilience as, 'the intrinsic capacity of a system, community or society predisposed to a shock or stress to adapt and survive by changing its non-essential attributes and rebuilding itself (Manyena, 2006, p.443). Combaz defines it as, '... the ability of individuals, communities, organisations and states to adapt to and recover from hazards, shocks or stresses without compromising long-term prospects for development' (2015, p.2). DFID defines disaster resilience as, 'the ability of countries, communities and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses – such as earthquakes, drought or violent conflict – without compromising their long-term prospects' (DFID, 2011a, p.6). UNISDR defines resilience as, 'The ability 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 structure and functions' (Blackburn and Johnson, 2012, p.92).

These definitions share four common elements. Firstly, they place emphasis on coping with shocks and stresses. Secondly, they emphasise recovery. UNISDR in particular qualifies the kind of recovery by adding the word 'timely' to its definition. Thirdly, all the definitions include direct reference or inference to adaptation. Manyena (2006) and Combaz (2015) use the word adaptation while DFID (2011a) and UNISDR (2012) use the words 'transforming' and 'accommodate' respectively. Fourthly, all of the definitions mention survival of long-term prospects, encapsulating a development perspective. Manyena's (2006) link is perhaps the least

strong with a mention of 'rebuilding itself' while Combaz (2015) and DFID use the same phrase, 'without compromising long-term prospects for development'. UNISDR (2012) draws in a development angle through its focus on the, 'preservation and restoration of essential basic structure and services' in its definition.

From a development and disaster management perspective, many factors affect the ability to be resilient. For example, a 2012 IIED report on the nature of urban risk states that high-income countries with appropriate financial, institutional and governance frameworks will have better resistance against shocks (Dodman et al., 2013). Much of this is due to the fact that basic infrastructure is safe and services reliable. Risks are often forecasted and prepared for. Resistance against shocks is more difficult in low-income countries due to gaps within the economic, institutional and social aspects of disaster risk management and safe urban development (The Government Office for Science, 2012).

According to Demchak (2010), other factors of importance include the ability to forecast, adapt and collectively problem solve along side the presence of trust, collaboration and knowledge. In studies on the military, Demchak found that 'repeated interactions are necessary to build the foundations for resilience, blending the social with the technical for collaborative knowledge development' (Demchak, 2010, p.74).

c.) Urban resilience

When investigating resilience in cities, physical and human elements comprise a large portion of the literature on what it means to be resilient. Physical elements broadly refers to infrastructure within the constructed and natural environment, while human components are often categorised as formal or informal social, economic and governance elements (Godschalk, 2003).

Within many of the urban resilience definitions a reference to being able to withstand or cope with hazards is often mentioned. For example, UNISDR's Making Cities Resilient Campaign uses the following definition: 'A resilient city is characterised by its capacity to withstand or absorb the impact of a hazard through resistance or adaptation, which enable it to maintain certain basic functions and structures during a crisis, and bounce back or recover from an event' (Twigg, 2007 in UNISDR's terminology, Blackburn and Johnson, 2012, p.11). Blackburn and Johnson note a focus on process can also build urban resilience such as, 'the process of urbanisation and planning; through sound development practices; inclusive political processes; and disaster risk reduction activities by government, citizens and other stakeholders' (2012, p.11).

Urban resilience is defined by da Silva in the City Resilience Framework as, 'the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience' (2014, p.3). This definition takes shocks and stresses into account, and highlights that urban resilience occurs at different scales. Moreover, this definition conceptualises the city through a systems lens.

Godschalk further focuses on systems in his definition of urban resilience, stating that 'A resilient city is a sustainable network of physical systems and human communities' (2003, p.137). The definition also raises the concept of sustainability as does the definition by the International Council for Local Environmental Initiatives (ICLEI), which states that 'Resilient cities reduce vulnerability to extreme events and respond creatively to economic, social and environmental change in order to increase their long-term sustainability' (2015, p.np). ICLEI's definition highlights the importance of understanding urban nuances and the diverse ways of influencing change when it continues to say, 'Resilient city activities are sensitive to distinctive unique local conditions and origins... As such,

resilient cities define a comprehensive 'urban resilience' concept and policy agenda with implications in the fields of urban governance, infrastructure, finance, design, social and economic development, and environmental / resource management' (2015, p.np).

Other definitions of urban resilience, such as the one from UN-Habitat's New Urban Agenda take more of a risk-based approach to analysing vulnerability, exposure and preparedness for protecting physical assets and human life. UN-Habitat's definition also takes a systems approach to the city, stating that 'the factors that influence a city's resilience include the range and severity of hazards; the risk to lives and property; the vulnerability and exposure of human, social, and environmental systems, and; the degree of preparedness of both physical and governance systems to any shock or stress' (2015f, p.2).

Having analysed various definitions of resilience from a socio-ecological, disaster and urban perspective, an analysis of conceptual debates about resilience will now be presented.

Conceptual elements of resilience

This section outlines key conceptual elements of resilience, analysing representations and debates commonly found in the literature.

Resilience has been critiqued for largely being a theoretical construct, an umbrella term that encompasses everything good and desirable (Bruijne, Boin and van Eeten, 2010). Bahadur *et al.* (2010) suggest the lack of specificity in definition comes from a weak link between research and practice. Tanner *et al.* argue that the wide applicability of the word can sometimes be its shortfall because without context and nuance, it risks becoming a 'catch-all buzzword', a concept possibly too vague to be useful (2015, p.3).

Due to its broad range of applicability, defining resilience for whom, and to what, provides a way of adding clarity to the concept. As established above, resilience can be used within a wide range of disciplines and paradigms. Within the disaster and development paradigm resilience can be used in relation to aspects related to climate change (Joakim, Mortsch and Oulahen, 2015), DRR (Kelman, Gaillard and Mercer, 2015) or conflict (Chandler, 2015). Defining resilience for whom is important when interrogating disaster resilience in cities because one hazard such as flooding, may identify traditionally vulnerable groups, while another hazard such as earthquakes, may identify some non-traditional groups i.e. middle class people who build multi-storey homes without adhering to building codes (Bahadur and Tanner, 2014).

There are strong links between resilience and livelihoods theory (Sanderson, 2016). For Cannon (2008), strengthening the resilience of a system is about strengthening and protecting livelihoods. The debate on how to protect livelihoods from a disaster then enters the realm of livelihoods theory with analysis of assets, power, capacity and vulnerability in a range of social, economic, political, environmental and physical ways described in Wisner *et al.*'s (2004) Access Model in section 2.2 above.

Perhaps one of the biggest arguments in favour of resilience is the opportunity it affords people to build upon what already exists. Resilience frames problems in a positive light while concepts like disaster risk reduction implies a need to 'reduce'. While some may call it splitting hairs, Manyena writes that the social metaphors we use have important implications because '...words are prisons, as well as searchlights and pigeonholes, for what we see' (2006, p.436). Taking action towards a better future for individuals, neighbourhoods and cities means aspiring to do more than attain the minimum standards for coping (McEntire *et al.*,

2002). Resilience thinking in disasters and development is about more than mere survival; it is about having the opportunity to thrive.

It has been argued that resilience can be understood as a process, an outcome, (Bahadur, Ibrahim and Tanner, 2010; Ahmed, 2006; Manyena, 2006) and a goal (McCreight, 2010), creating potential for further conceptual confusion. McCreight (2010) views resilience as a goal of restoring civil and public safety, economic and governance operations after a disaster, even if it takes years to achieve. While viewing resilience as a goal is not wholly negative, it has been criticised for setting the standard of disaster management too low, and it is on this basis that Manyena (2006) argues resilience is more than restoration or survival, that its about the aspiration for a better life.

Resilience as an outcome has also been criticised by Manyena as being too reactive and response driven by its focus on concepts such as 'cope', 'bounce back', 'withstand', 'absorb negative impacts' without addressing the preparedness aspect of resilience. Meanwhile, Kaplan (1999) views resilience as a desired outcome of a process. Viewing resilience as a process means disaster resilience is seen as a characteristic, quality or result generated by a process (Bahadur, Ibrahim and Tanner, 2010). While the difference might seem small, a minimum consensus on the defining features of resilience as a goal, outcome or process may assist with the ability of different disciplines to interface on the topic (Quarantelli, 1995).

Resilience has a history of being criticized for promoting the status quo by enabling systems or communities to 'bounce back' (Twigg, 2009). Therefore, proponents of resilience prefer to talk about 'bouncing forward', suggesting disasters as a potential opportunity (Folke, 2006) for systems to metastasise and adapt into new shapes that improve their operation. Some scholars believe that bouncing back and maintaining the same core functions can be reckless, and sometimes even dangerous, when the status quo is one of corrupt governance, flailing economic

policies and restricted civil rights (Pelling, 2011a). Berkhout (2008) observes that resilience has a 'dark side' and that there may be good reasons for wanting to transform a system such as slavery, terrorist groups or fossil fuel-based energy. When the state of return is undesirable, transformation is sometimes suggested as an alternative. Pelling (2011a) proposes transformation is on the same continuum as resilience but offers a regime change when power dynamics are unequal and unjust. Due to the emphasis on shifting power, Bahadur and Tanner (2014) argue that resilience ought to be coupled with transformation.

Perhaps the debate about state of return could be assisted in part with clarifications in the conceptual relationship between resilience and adaptation (Gallopín, 2007; Bahadur, Ibrahim and Tanner, 2010; Manyena, 2006; Ahmed, 2006). While some view adaptation and resilience as interchangeable terms (Ahmed, 2006), others understand adaptation to be a separate concept, usually linked to climate change (Pelling, 2011a). Adaptive capacity is often included in the definition of resilience because a response to unanticipated risks requires a degree of flexibility (Johnson and Blackburn, 2014). Surjan *et al.* view adaptation as separate from resilience but with what they call 'an unavoidable association' (2011, p.30). Janssen *et al.* (2006) propose that there may always be difference in how academics understand the concepts of resilience and adaptation due to the different knowledge domains each one originates from.

Resilience can be critiqued for not recognising the role of power (Friend and MacClune, 2013). In an Annual Resilience Scan for ODI, Tanner *et al.* (2015) write that 'calls for more attention to political, power and normative dimensions [of resilience] have now reached a critical mass'. Moreover, a systems approach to resilience is critiqued for its emphasis on physical systems and not humans within the systems (Bahadur and Tanner, 2014). However, there are a number of conceptualisations and frameworks that emphasize power, social justice and equity. Mayunga

(2007) views resilience as a determined by five capitals commonly used in the sustainable livelihoods approach: social, economic, human, physical and natural. Adger (2001) defines resilience in relation to the ability of communities to withstand shocks to their social infrastructure. The Resilience Alliance (2007) approaches resilience from the perspective of how much change a system can endure and still function, placing an emphasis on stability, self-organisation and learning, all human components. Twigg (2009) uses the Hyogo Framework for Action to define components and characteristics of resilience based on five thematic areas of governance; risk assessment; knowledge and education; risk management and vulnerability reduction; and disaster preparedness and response. Cutter (2008) conceptualises resilience as the nexus between social systems, natural systems and the built environment. Therefore the literature suggests human systems and their influence on power and equity can in fact be considered within resilience, and when done so, provides a more holistic approach.

2.3.2 Practice of resilience

This section examines some of the debates regarding the practice of resilience. It then analyses the ways in which frameworks operationalise resilience at a global, city and community scale.

At a practical level, justification for focusing on resilience-building has come from the argument that because humanitarian needs are high and the resources for meeting needs low, resilience can play an important role in crisis prevention (Pain and Levine, 2012). The 2011 Humanitarian Emergency Response Review (HERR), commissioned by the UK Government, specifically states this when it writes, 'It should not be forgotten that building resilience is often the best means of providing value for money' (2011, p.53). With austerity measures being put in place in some donor countries, a migrant crisis on the shores of Europe and a 'global war on terrorism' there are many strains on donor countries.

Therefore, DFID in particular has recommended a budget for resilience and has declared in its strategy that the agency must, 'place the creation of resilience at the heart of [its] approach both to longer-term development and to emergency response' (Ashdown, 2011).

Secretary General, Elhadj As, and Senior Vice President, Sven Molleklev, of IFRC (2015) write that within the debate about value for money is another debate about whether humanitarian aid should be spent on 'the most pressing and urgent suffering' or on 'longer-term solutions'. They argue that resilience is necessary because it allows both to be achieved, thereby bridging the gap between disasters and development. Combaz (2015) writes that while the terminology of disaster resilience is still new, emerging evidence suggests resilience is a cost-effective way to save lives and protect development gains, thereby integrating two paradigms that have traditionally been quite separate in practice (Collins, 2009).

While resilience is appealing because of its diverse application, some argue that it is precisely this quality that makes it harder to operationalise (Tanner et al., 2015). After a study of the DRR activities of local governments participating in UNISDR's Making Cities Resilient Campaign in 50 cities, Johnson and Blackburn (2014) propose that operationalising resilience means resisting a hazard; coping with a hazard; recovering from a hazard; and adapting to ensure past mistakes are not repeated. In other words, 'Resilience = resistance + coping capacity + recovery + adaptive capacity' (Johnson and Blackburn, 2014, p. 48).

No consensus on how to measure resilience currently exists, therefore making measuring resilience a challenge, according to some (Winderl, 2014; Arbon et al., 2013; Oddsdottir, Lucas and Combaz, 2013). However, aid agencies, governments and donors want to measure and monitor resilience to understand the impact of their interventions. To this end a Resilience Measurement Technical Working Group under the Food

Security Information Network (FSIN) was set up by the Food and Agriculture Organization (FAO) and the World Food Programme (WFP) to find a way to universally measure resilience (Food Security Information Network, 2015). Scholarship has found that measuring characteristics is the most common form of operationalising resilience (Tanner et al., 2015). However, Bene (2013) argues that inductive approaches whereby specific characteristics are identified as the foundation of resilience and used to measure it can be critiqued for being too case specific; reflecting the discipline or background of the researcher; and for not being constructed from a deductive, generalisable approach, which can lead to circular analysis. Bene therefore argues that there is a need to develop indicators not based on characteristics of resilience, but on the costs of resilience such as different 'ex-ante and ex-post investments, losses, sacrifices, and costs that people have to undertake at individual and collective levels to 'go through' a shock or an adverse event' (2013, p.11). Bene's formula for measuring resilience in simplified terms is: 'resilience = anticipation costs + impact costs + recovery costs' (2013, p.12). The literature suggests that when measuring resilience, especially from a systems approach, it is widely agreed that frameworks should be multi-sectoral and multi-scalar (Carpenter et al., 2001; Folke, 2006).

There are concerns that operationalising resilience means placing an emphasis on local self-reliance, thereby eroding the state's responsibility to protect its citizens (Griffin, 2011). Beilin and Wilkinson (2015) argue that urban disaster resilience is best built at multiple scales through bottom-up methods of self-organisation and internal capacity in conjunction with top-down, centrally coordinated government policy based activities. Chandler argues that the concept of self-reliance highlights agency and self-empowerment of local actors (Chandler, 2015) whose participation in building resilience at every stage of the disaster management cycle is crucial (Bahadur, Ibrahim and Tanner, 2010). Therefore, the literature suggests the importance of self-reliance and

active engagement in disaster preparedness and response by the government.

Global policy agendas and frameworks

This section reviews frameworks, summits and recently agreed global goals concerning resilience, beginning with four global frameworks that have current influence on policy then moving to a selection of frameworks that operationalise resilience in cities and communities. A review of 26 frameworks is then presented. The frameworks were chosen because they reflected the key debates around resilience highlighted earlier in this chapter, namely that resilience includes disaster and development dimensions; is community driven (bottom up) and policy derived (top down); is holistic in its approach, which is represented through consideration of physical, social, economic and governance aspects. The frameworks were also chosen because they represented a range of scale from global to neighbourhood. In summary, each of the 26 frameworks provided analysis of the concepts of urban, disaster and resilience.

Six frameworks that were felt to be most relevant to this research were then chosen for analysis. These six were chosen because they were developed for operational purposes; covered different scales (global to neighbourhood); included policy and non-policy activities; and were put in practice or created for use by foundational thinkers or well known operational aid agencies. Finally, some of the six frameworks also included systems thinking, an integral part of this research.

a.) Sendai Framework for Disaster Risk Reduction

The Sendai Framework for Disaster Risk Reduction 2015-2030 is a global framework for preventing and reducing disaster risk in countries around the world (UNISDR, 2015c). It was adopted in March 2015 in Sendai, Japan, building on achievements made by its predecessors, the Yokohama Strategy for a Safer World: Guidelines for Natural Disaster Prevention,

Preparedness and Mitigation 1994-2004 (IDNDR, 1994), and the Hyogo Framework for Action 2005-2015 (UNISDR, 2007), which is discussed further below. The framework applies to a range of disasters small and large, frequent and infrequent, human induced or resulting from natural hazards. The framework's expected outcome is to reduce disaster risk, specifically in terms of loss of life, livelihoods and health while reducing damage to 'physical, social, cultural and environmental assets' (UNISDR, 2015c, p.12).

The overall goal of the framework is to strengthen resilience through a long list of multi-sectoral areas (including 'economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional' areas (UNISDR, 2015c, p.12)) that reduce exposure and vulnerability and increase preparedness, response and recovery measures. To meet the framework's goal, four priority actions have been listed of which resilience is number three. The priority action for resilience is phrased as 'Investing in disaster risk reduction for resilience' and includes priorities such as 'public and private investment' in 'structural and non-structural measures' in order to 'enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets as well as the environment' (UNISDR, 2015c, p.12).

The Sendai Framework places emphasis on the importance of a holistic approach to risk reduction through multi-sectoral means. It suggests that resilience is intertwined with achieving successful physical, social, economic and governance aspects of preparedness and response at a range of scales from local to national. It also emphasizes the 'preparedness' aspect of resilience and measures that can be taken through good development before exposure to shocks can occur.

b.) World Humanitarian Summit

The World Humanitarian Summit (WHS) is a process aimed at setting a new humanitarian agenda to meet the scale and complexity of today's global challenges. With nearly 60 million people displaced by crises, and an annual global spending on recovery from natural hazards in excess of USD 300 billion globally, the humanitarian system, many argue, is overstretched (WHS, 2015b). Between 2013-2015 the WHS process consulted over 23,000 people in 151 countries who engage with the humanitarian system (including aid recipients) in order to develop a set of actions for how humanitarian aid can be improved, to be agreed at the Summit held in May 2016 (WHS, 2015a). Consultations focused on the thematic areas of urban, stakeholder engagement and private sector partnerships. From those consultations a synthesis of five major areas for action was drawn up, which included: dignity, safety, resilience, partnership and finance. The resilience action point states that humanitarian aid will build hope and solutions in new or prolonged crises between development and humanitarian partners by 'investing in preparedness, managing and mitigating risk, reducing vulnerability, finding durable solutions for protracted displacement, and adapting to new threats' (WHS, 2015b, p.3).

The inclusion of resilience in the WHS Agenda demonstrates that resilience is prioritised as a key action that contributes to the goal of improving the global humanitarian aid system. Furthermore, in a similar vein to the resilience definitions discussed earlier, the WHS Synthesis Report suggests that activities related to resilience should emphasize preparedness, the reduction of vulnerability and adaptation measures (WHS, 2015b).

c.) 2030 Agenda for Sustainable Development

The 2030 Agenda for Sustainable Development also focuses on resilience. It is a universal agenda with 17 goals aimed at eradicating poverty, protecting the planet and ensuring prosperity for all (United Nations, 2015a). The 17 Sustainable Development Goals (SDGs) follow on from

eight Millennium Development Goals (MDGs) created to reduce poverty from 2000-2015 (United Nations, 2015a). SDGs nine and 11 mention the word resilience in relationship to infrastructure and cities respectively.

Goal nine is to 'Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation' while goal 11 is to 'Make cities and human settlements inclusive, safe, resilient and sustainable' (UNDP, 2015, np). In goal nine resilience is used in relation to infrastructure, which suggests qualities more in line with traditional engineering definitions of resilience (Godschalk, 2003). Meanwhile, goal 11 takes a more socio-political view of resilience in relation to cities and settlement, noting that resilient cities and settlements include affordable public housing, good public transport, green open spaces and employ inclusive urban planning processes (UNDP, 2015).

d.) Habitat III, the New Urban Agenda

Habitat III, shorthand for the United Nations Conference on Housing and Sustainable Urban Development, is the means through which a New Urban Agenda will be agreed upon in Quito, Ecuador in October 2016 (Habitat III, 2015a). The New Urban Agenda will guide sustainable development in cities and towns until 2036 (Citiscopes, 2015). Its predecessor was Habitat II, the Habitat Agenda: Istanbul Declaration on Human Settlements, calling for adequate shelter for all, and was agreed to in 1996 (Habitat II, 1996). A broad spectrum of stakeholders is participating in Habitat III, including civil society, various levels of government, regional governance bodies, development actors and funders. Before the New Agenda is agreed upon, 22 key issues have been selected for debate and exploration, one of which is urban resilience. The Issue Paper on resilience refers extensively to hazards, vulnerability, climate change, disaster risk reduction, shocks and stresses, governance and urban planning in an effort to identify key drivers of urban resilience (Habitat III, 2015f). The 'operationalisation' of the concept resilience is described as taking place through activities that

target physical infrastructure and basic service provision, jobs, good governance, social inclusion and environmental sustainability.

e.) Operational frameworks for resilience

In addition to the four global frameworks reviewed above, an analysis of 26 operational frameworks was conducted by the author to understand how resilience was being implemented in cities and communities. On that basis, six frameworks were chosen for in-depth analysis in order to identify strengths, weaknesses, their relevance to urban disaster resilience and the key concepts employed. The next section is a summary discussion of the relevant aspects of each of the six frameworks. A more in-depth analysis of the six frameworks can be found in the CD appended to this thesis.

Six frameworks were chosen to represent key approaches to operationalising or understanding resilience deemed most relevant to this research. The criteria for choosing the frameworks was based on the literature review conducted earlier in this chapter. The criteria are: global level policy frameworks on disaster risk reduction, community based resilience, urban frameworks with a systems focus, climate change in urban areas, place-based assessments to natural hazards and frameworks for resilience that are used by humanitarian networks.

The first, the Hyogo Framework for Action (HFA) framework by UNISDR (2005b), the precursor to the Sendai Framework for Disaster Risk Reduction, discussed above, was selected to understand how a global framework for disaster risk reduction operated, was monitored and evaluated and engaged a broad range of stakeholders at various levels in its five thematic areas. The HFA was analysed not only because it influences global policy and national risk reduction activities, but also because it combines development and disaster approaches in three goals, which are to 1.) reduce risk in sustainable development activities; 2.)

improve governance by developing the capacity and resilience of institutions; and 3.) to incorporate disaster risk reduction into every stage of the disaster management cycle (UNISDR, 2011).

Twigg's (2009) guidance note, *Characteristics of a Disaster Resilient Community*, commissioned by six international NGOs (ActionAid, Christian Aid, Plan UK, Practical Action and Tearfund), along with the British Red Cross, depicts what a disaster resilient community looks like. It uses the five thematic areas represented in the HFA, demonstrating how a global framework can be integrated at the community level. The five thematic areas are then broken into three sub-sections. There are 28 'components of resilience' which act as key activities that serve to identify what disaster resilience is. There are 167 'characteristics of a disaster-resilient community', which illustrate what an ideal disaster resilience community looks like. There are also six characteristics of an 'enabling environment', which create the conditions for the components of disaster resilience to be achieved.

Da Silva *et al.*'s *Urban Resilience Framework* (2010), which was designed to respond to climate change challenges at a city scale, was also reviewed. The framework employs a systems approach to understanding cities, specifically focusing on the linkages between 'interdependencies, agencies, vulnerabilities and capacities' within systems. It also analyses shocks and stresses together, highlighting in particular the role of physical and institutional systems (da Silva *et al.*, 2010, np). It is split into two broad categories, one that analyses vulnerability, the other which identifies ways to build resilience. Both consider the role of external and internal agents as well as urban systems.

Moser's *Conceptual and Operational Framework for Pro-Poor Adaptation to Urban Climate Change* (2011) also analyses urban resilience to climate change hazards with a specific emphasis on assets instead of systems. The

temporal aspect is more drawn out than in any other framework analysed through an assessment of asset vulnerability followed by an adaptation of assets in four 'phases' that include long-term resilience; pre-disaster; immediate post-disaster and rebuilding (2011). Moser (2011) also conducts analysis at individual, household, and community scales.

Cutter *et al.*'s DROP model (2008), which is designed to assess disaster resilience to natural hazards at a community or local level, was also analysed and found to focus on vulnerability and the ways in which communities adapt or cope. The framework analyses the antecedent conditions (existing vulnerability) alongside characteristics of a specific hazard and coping responses of the community as a formula for understanding disaster resilience.

Lastly, the IFRC's Characteristics of a Safe and Resilient Society (ARUP, 2011) was analysed in order to understand how the world's largest humanitarian network is implementing resilience. The characteristics in the research were intended to be used 'in the design, monitoring and evaluation of future programmes,' thereby offering a way of seeing resilience operationalised (ARUP, 2011, p.ii). The framework identifies six characteristics for resilience within a community: knowledge and health; economic opportunities; infrastructure and services; natural resources; organisation; and connectivity (ARUP, 2011). It places health and knowledge at the centre, arguing that other aspects were also important such as the ability to be organised in order to identify and act on problems; to be connected with external actors, the environment and supply chains; to manage natural assets that protect the environment; to create economic opportunities and access infrastructure and services such as housing, transport and power.

The in-depth analysis of the six frameworks or methods for operationalising resilience alongside an analysis of 20 other frameworks

highlighted that resilience is currently being used in a variety of ways. Furthermore, it suggests that many frameworks place their chosen area of focus at the centre of analysis, be it health (as in the case with the IFRC research), climate change (as was seen in Moser and da Silva *et al.*'s frameworks) or natural hazard risk (as was the case for Cutter *et al.*'s DROP model). All of the frameworks had strong social and governance components to them, while one out of two urban frameworks had a strong emphasis on physical aspects (da Silva *et al.*, 2010). Having selected all of the frameworks from a disaster management-development paradigm, it is worth noting that none of the 26 frameworks had an urban morphology component to them. Table 2.3.3a below provides a list of the six frameworks that were chosen for in-depth analysis. Table 2.3.3.b below provides a list of 26 frameworks reviewed.

An in-depth review of six resilience frameworks		
	Author	Framework
1	(UNISDR, 2005b)	Hyogo Framework for Action
2	(Twigg, 2009)	Characteristics of a Disaster Resilient Community
3	(da Silva <i>et al.</i> , 2010)	The Urban Resilience Framework
4	(Cutter <i>et al.</i> , 2008)	Disaster Resilience of Place (DROP) Model
5	(Moser, 2011)	A Conceptual and Operational Framework for Pro-Poor Adaptation to Urban Climate Change
6	(ARUP, 2011)	Characteristics of a Safe and Resilient Community

Table 2.3.3a: A list of the six frameworks chosen for in-depth analysis. Source: the author

A review of 26 resilience frameworks		
	Author	Framework
1	(UNISDR, 2005b)	Hyogo Framework for Action
2	(Twigg, 2009)	Characteristics of a Disaster Resilient Community
3	(da Silva et al., 2010)	The Urban Resilience Framework
4	(Cutter et al., 2008)	Disaster Resilience of Place (DROP) Model
5	(Moser, 2011)	A Conceptual and Operational Framework for Pro-Poor Adaptation to Urban Climate Change
6	(ARUP, 2011)	Characteristics of a Safe and Resilient Community
7	(U.S. Indian Ocean Tsunami Warning System Programme, 2007)	How Resilient is Your Coastal Community? A Guide for Evaluating Coastal Community Resilience to Tsunamis and Other Coastal Hazards
8	(World Bank, 2012a)	Building Urban Resilience: Principles, Tools and Practice
9	(EMI, 2012)	Programmatic Directions for the Red Cross and Red Crescent in Building Urban Community Resilience in the Asia Pacific Region
10	(Rivera and Settembrino, nd)	Toward a Sociological Framework of Community Resilience
11	(Kafle, 2010)	Integrated Community Based Risk Reduction: An Approach to Building Disaster Resilient Communities
12	(DFID, 2011b)	Saving Lives, Preventing Suffering and Building Resilience: The UK Government's Humanitarian Policy
13	(Wongbusarakum and Loper, 2011)	Indicators to Assess Community Level Social Vulnerability to Climate Change: An addendum to SocMon and SEM Pasifika Regional Socioeconomic Monitoring Guideline
14	(Renschler et al., 2010)	Developing the 'Peoples' Resilience Framework for Defining and Measuring Disaster Resilience at the Community Scale
15	(ADPC, 2006)	Critical Guidelines: Community-Based Disaster Risk Management
16	(Turner et al., 2003)	A Framework for Vulnerability Analysis in Sustainability Science
17	(UNISDR, 2013)	The Pacific Experience in Developing Policy

A review of 26 resilience frameworks		
	Author	Framework
		and Legislation on Disaster Risk Reduction and Climate Change Adaptation
18	(DFID, 2011a)	Defining Disaster Resilience: A DFID Approach Paper
19	(Tyler and Moench, 2012)	A Framework for Urban Climate Resilience
20	(IDNDR, 1994)	Yokohama Strategy and Plan of Action for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation
21	(Heijmans, 2013)	Reaching Resilience: Handbook Resilience 2.0 for Aid Practitioners and Policymakers
22	(TANGO International, 2012)	The Resilience Framework
23	(da Silva, 2014)	The City Resilience Framework
24	(da Silva, Kernaghan and Luque, 2012)	A Systems Approach to Meeting the Challenges of Urban Climate Change
25	(Shaw, 2014)	Urban Disaster Risk Reduction Framework
26	(Suri, 2015)	Resilient cities for children: a strategic framework for World Vision

Table 2.3.3b: A list of the 26 frameworks chosen for review in relation to urban disaster resilience. Source: the author

In summary, this section on resilience has covered practical challenges and debates with operationalising resilience. It then reviewed operational frameworks in order to gain an understanding of the key concepts and ways in which those concepts interact. The next and final section offers and interpretation of urban disaster resilience for this research.

2.3.3 Defining urban disaster resilience for this research

After conducting a literature review of cities, disasters and development, as well as the theory and practice of resilience, it is important for this research to be clear how it defines urban disaster resilience. This research therefore defines resilience as ‘the capacity for dynamic systems to cope, adapt and transform in ways that reduce future risks to shocks and stresses’. Furthermore, it defines urban disaster resilience as ‘the ways in

which the interactions between the built environment, complex adaptive systems and people build the capacity to cope with shocks and stresses and re-organise in order to reduce future disaster risk’.

Conclusion

This chapter presented a literature review of theories related to conceptualising the city, disaster development and resilience. It began with an explanation of the ways in which development theory fostered urban growth. It then conceptualised the city from a CAS and urban morphology approach, observing that such approaches account for the interdependencies and complex overlaps between humans and the built and natural environments they live in. Specific opportunities and challenges within the city were identified through the examination of urban form and risk; economic systems and their impact on the informal sector; governance systems and the role of key actors as well as social systems and the way relationships can become successful socioeconomic coping mechanisms. The chapter concluded with a discussion on the history of resilience, including key conceptual and practical debates about the concept.

The literature review has identified some key aspects for consideration in the development of a conceptual framework for understanding urban disaster resilience. In particular, the development theory section of this chapter underscored the need for inclusive, participatory methods in order to foster inclusive, safe and just cities for all, including poorer people. Analysis of urban form highlighted the physical risks brought out by informality in buildings, specifically homes. Meanwhile the analysis of economic systems emphasised the role of informality and the need for greater economic access for poorer people in urban centres. Furthermore, analysis of governance systems concluded that the rule of law, including planning policies and development strategies at the national level, are as important as individual ‘self-help’ systems and networks that informally

govern poorer areas of cities and neighbourhoods. Meanwhile, the social systems analysis emphasised that people with monetary weaknesses have stronger economic and political access when they work together.

The disasters section highlighted a history of theories and approaches that attempt to link disasters and development, suggesting that resilience is the latest of such attempts and differs by way of using systems instead of asset analysis. The resilience section demonstrated that while the concept has some obstacles conceptually and practically, it has gained a lot of uptake in global policy agendas and local frameworks. Then next chapter will use this literature review to formulate a conceptual framework for understanding urban disaster resilience.

Part II. Research approach

Chapter three

A conceptual framework for urban disaster resilience

Introduction

This chapter formulates a conceptual framework for understanding disaster resilience in low-income neighbourhoods with a view to use it to identify key dimensions of resilience. To this end, two urban approaches for analysing the city are aggregated to create a conceptual framework that investigates human interactions and their influence on built form. Complex adaptive systems (CAS) and urban morphology are combined to create a framework for investigating patterns of urban vulnerability, capacity, risk and opportunity in order to understand dimensions of disaster resilience, and the ways in which the concept assists with improving disaster response.

This chapter begins by explaining CAS and the reason for choosing three CAS for the framework. A definition of the chosen economic, social and

governance CAS is given followed by an explanation of how the CAS systems were triangulated with other systems frameworks. The urban morphological component of the conceptual framework is then presented through four layers of analysis within the built and natural environment. The four layers comprise topography, movement networks and public open spaces, plots and buildings and services and exist in order to conduct scalar analysis of human interaction with the built and natural environment. The chapter concludes by illustrating how CAS and morphology can be integrated into a single approach for analysing disaster resilience in the city.

Methodological approach

A literature review was the primary methodological approach employed to develop the conceptual framework, as presented in Chapter Two. The literature review examined different conceptualisations of CAS and urban morphology in order to understand how they explain the city and its inter-connections. The review of theory is a deductive approach to forming the conceptual framework, whereby key theories are reviewed and used to form the foundation of the framework. A review of 26 resilience frameworks that guide practice was then conducted across a range of thematic areas within resilience, including climate change, community resilience, place-based resilience and global disaster risk reduction frameworks. The frameworks were examined in Chapter Two in order to ascertain key characteristics and themes of resilience that could be generalised, again employing a deductive approach to test commonalities within practice. Moreover, the examination of practical frameworks made connections between theory and practice.

The key links that were drawn from theory included emphasis on social capital, microfinance, secure land tenure and the importance of temporality and scale when building capacity to withstand and recover from disaster shocks. Meanwhile practice revealed an emphasis on

building capacity, forming partnerships and developing multi-sectoral approaches.

Having explained the methodological approach for this chapter, the aim of the conceptual framework is presented next. The development of the conceptual framework is then explained starting with CAS and then moving to morphology. A rationale for using the approaches is then explained.

3.1 The conceptual framework's aim

The aim of developing an urban disaster resilience framework in this chapter is to understand changes in the contemporary urban fabric that take place as a result of influence from CAS and visa versa. Through urban morphology, the framework will analyse the quality of the urban built and natural environment, and serves as the basis for asking, how did the neighbourhood become what it is today and what are the key dimensions of resilience that can be identified within it?

The framework comprises a horizontal axis (complex adaptive systems) and a vertical axis (urban morphology), illustrated in Figure 3.1a. The CAS elements of the conceptual framework identify patterns of resilience, risk, capacity and vulnerability. Meanwhile, the morphological elements highlight changes within the built and natural environment as shown Figure 3.1a below.

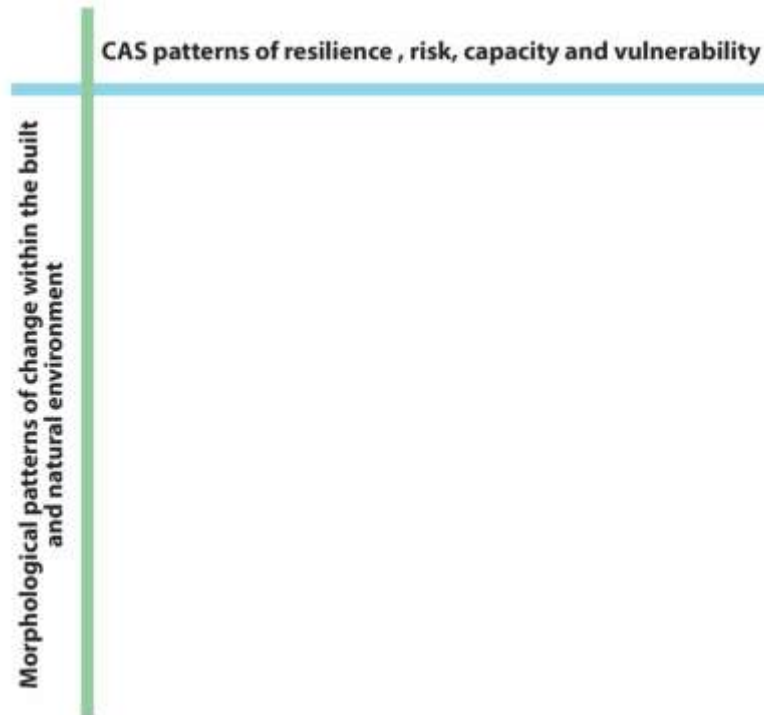


Figure 3.1a: The CAS aspect of the conceptual framework is represented in blue (horizontal axis), and analyses patterns of resilience, risk, capacity and vulnerability. The morphological element of the conceptual framework represented in green (vertical axis), analyses changes within the built and natural environment. Source: the author

The conceptual framework is structured in order to conduct analysis by asking: what interactions took place at the intersections between the systems and the morphological layers? Did the impact at the intersections create resilience? Was the resilience positive or negative? The next section explains the CAS components of the framework.

3.2 Complex adaptive systems: the framework's horizontal axis

This research contends that urban disaster resilience can be analysed effectively using a theoretical landscape that acknowledges and accommodates overlap, complexity and adaptive behavior (da Silva, 2014; Anderies, Walker and Kinzig, 2006). Therefore, systems theory is used in this research as one of two key theories because it recognises cities and

neighbourhoods as complex adaptive systems that have a plethora of feedback loops that are created through intra and inter-dependent causal and adaptive relationships (Walker et al., 2004; Holling, 2001; Walker et al., 2006; Juarrero, 2000; da Silva, Kernaghan and Luque, 2012). The horizontal axis of this framework is host to three key interdependent complex adaptive systems used for analysis in this framework: economic flows, governance networks and social dynamics. Economic flows in this conceptual framework are defined as economic benefits such as money, markets, businesses, rent, jobs, savings, loans, credit, ownership and skills. Governance networks (Resilience Alliance, 2007) involve the organisation of power and decision-making such as government, institutions, leaders, networks, planning policies and legal frameworks. Social dynamics (Resilience Alliance, 2007) are defined by social interaction such as networks, social capital, discrimination, culture and values. It also includes social services such as education, welfare and healthcare. These three CAS were identified after the literature review of theories and frameworks in Chapter Two. The next section will provide further a justification of the three systems chosen for the framework by triangulating them with three other influential systems frameworks. Figure 3.2a below shows the overlapping nature of the economic flows, governance networks and social dynamics CAS.

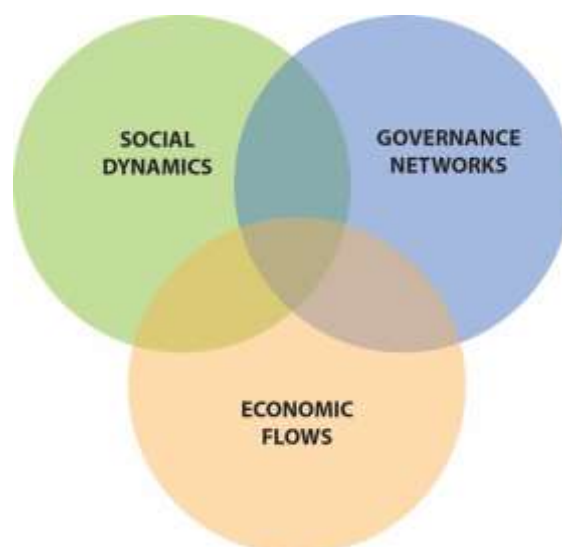


Figure 3.2a: A diagrammatic representation of overlapping economic flows, governance networks and social dynamics CAS. Source: the author

3.2.1 Economic flows

Economic flows provide economic benefits to individuals, neighbourhoods, cities and nations. Economic benefits and losses can arise at any given time in the production, supply and consumption of goods (Resilience Alliance, 2007). Urban areas are consumption driven, meaning people are required to purchase basic necessities such as food, water, shelter and electricity often from other areas in order to survive (Friend and MacClune, 2013). Regardless of race, ethnicity, gender or creed, unrestricted access to money, markets, loans, insurance, credit and microfinance are crucial to ensuring unhindered economic flows for poorer urban people who often grapple with unstable financial asset bases, indebtedness and lack of access to loans or insurance (da Silva, 2014). Equally important is access to skills training and employment in decent work occupations supported by social protection and security (ILO, 2002). Finally, ownership of assets such as land, houses and rooms for rent greatly impacts the economic stability of an individual, neighbourhood and city, and are therefore included in the definition of economic flows. The recent rise of the urban 'sharing economy' also creates opportunities for asset owners to rent out their services or assets for a small fee (The Economist, 2013). Having explained the economic CAS in the framework, the next section will focus on the governance CAS.

3.2.2 Governance networks

Governance networks CAS in the framework consists of institutions, governments, the private sector (and their tools such as planning policies and legal frameworks). The governance CAS also includes processes that shape power sharing, decision-making, participation, justice, and agency (Siisiainen, 2000; Friend and Moench, 2013; Allen, 2003). Governance networks strongly impact on social systems by constraining or enabling access for different groups of people. Good governance networks are

integrated; inclusive, exchange information and have accountable authorities (Anderies, Walker and Kinzig, 2006; Arup International, 2014; MacClune, Tyler and Allan, 2014). Integrated networks ensure investment and management of all sectors and departments and are aligned to a mutually supported outcome (da Silva, 2014). Good governance engages a broad range of stakeholders, including civil society, in a shared ownership of a joint vision (Anderies, Walker and Kinzig, 2006).

Good governance also relies on information exchange that is accurate and shared in a timely manner to shorten feedback loops and protect public safety when shocks or stresses occur (da Silva, 2014). Finally, government authorities should be transparent in their decision making and accountable to the public (MacClune, Tyler and Allan, 2014). Therefore this CAS component of the framework will be considering elements of good governance, civil society networks and accountability in decision-making processes. The next section will explain the way in which the framework will analyse social dynamics CAS.

3.2.3 Social dynamics

Social dynamics are comprised of dynamic interactions such as networks, social capital, leadership, discrimination, cultural values (Putnam, 2007; Keeley, 2007; Siisiainen, 2000; Stephenson, 2011; Anderies, Walker and Kinzig, 2006). Healthcare, education, financial structures, social welfare nets and the like are also included in social systems (Wallace and Wallace, 2008). A resilient social dynamic system has the ability to self-organise, is capable of facilitating collective action and engenders trust (Putnam, 2007; Anderies, Walker and Kinzig, 2006). The qualities of resilient dynamic social systems are understood to include learning, resourcefulness, and responsiveness (Levine, 1998).

Social systems demonstrate learning through evolving practices (Reed et al., 2013) such as forming a savings group to access livelihood loans but

then adapting the purpose of the group to also include allowances for social welfare needs. Resourcefulness is demonstrated when people are able to identify a variety of ways to achieve their livelihood and well-being goals, even in response to a disaster shock. Lastly, social systems are responsive when they are able to make decisions in a timely manner and take appropriate actions to adapt to shocks (MacClune, Tyler and Allan, 2014). This framework will consider how the social dynamics explained above interact as part of understanding how the social CAS works in a city.

3.2.4 Triangulation: a review of three urban resilience frameworks

By way of further triangulating the justification for the categorisation of CAS in this framework, a critical review of three recent systems frameworks for urban resilience is conducted in order to ascertain similarities and differences between the categories of this conceptual framework and those developed by others. A short discussion of the findings and how they support the choice of the categories in this framework is outlined below.

Resilience Alliance (2007)

The Resilience Alliance describes cities as the ‘quintessential example of a complex adaptive system’ because they are constantly evolving based on ‘internal interactions and the influence of external factors’ (Resilience Alliance, 2007, p.9). Following a workshop in Gothenburg, Sweden in 2005, the Resilience Alliance developed key themes to guide a systems approach to building the general resilience of a city and its component parts (Resilience Alliance, 2007). The four themes developed were: 1.) *metabolic flows*, described as the production, supply and consumption of goods; 2.) *governance networks*, defined as organisations and mechanisms of good governance that redistribute equitable services and benefits to an urban population; 3.) *social dynamics* defined as the social patterns that influence density, shape human capital, access and inequality; and 4.) *the built environment*, referring to the spatial organisation of the city and its

infrastructure, and the way it interacts with ecosystem service provision (such as food and water). The interaction and overlapping nature of the themes is pictured below in Figure 3.2.4a.

The urban disaster resilience conceptual framework developed by the author in this chapter uses the Resilience Alliance's four themes as the basis for its categorisation of systems, with some modifications as demonstrated in Figure 3.2.4b. As explained in section 3.2 above, the author's framework uses three systems that are similar in nature to the Resilience Alliance's framework, namely social, governance and economic. However, the economic aspect in the author's framework is described as economic flows while the Resilience Alliance uses the term 'metabolic flows'. The 'metabolic flows' category is defined by the Resilience Alliance as 'production, supply and consumption chains'. However, it arguably lacks a focus on people and their relationship to economic resilience. Therefore, the definition of the 'economic flows' system is believed to provide a greater focus on the ability of groups and individuals to economically thrive, and shall be defined in this conceptual framework as economic benefits such as money, markets, businesses, rent, jobs, savings, loans, credit, ownership and skills.

Another notable change between the two frameworks is the author's emphasis on the physical component by using urban morphology to analyse the built and natural environment. Therefore the three CAS systems that are similar in nature to the Resilience Alliance are shown in blue in Figure 3.2.4b below while the green circle indicates a greater emphasis on the built and natural environment in order to account for the importance of the interaction between the built environment and people.

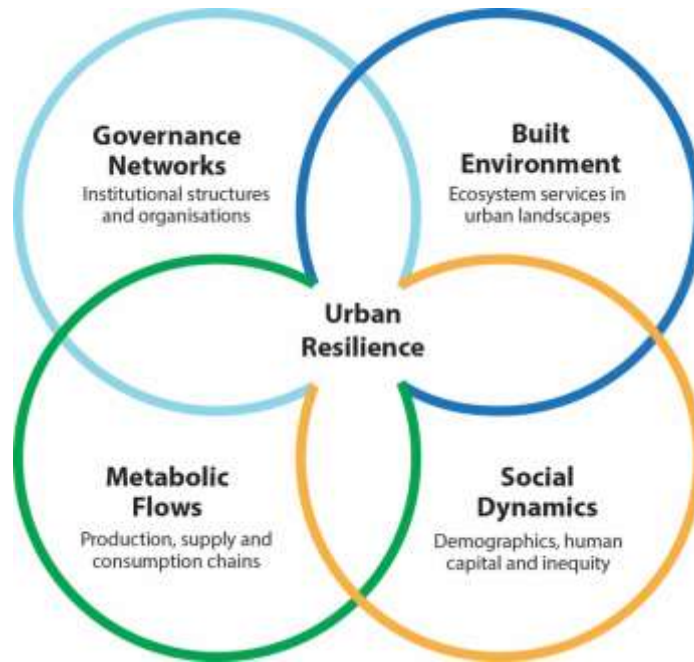


Figure 3.2.4a: An interpretation of The Resilience Alliance’s (2007) key themes for building the urban resilience within a city and its component parts. Source: the author

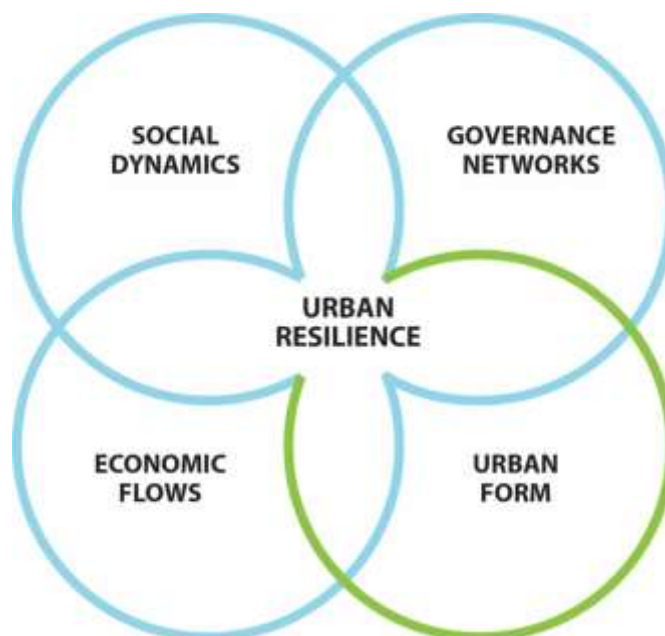


Figure 3.2.4b: The author’s framework builds on the knowledge of the Resilience Alliance (2007) by using similar social and governance systems while making modifications to the way in which economic systems is understood (as indicated in blue). Urban form is indicated in green and will be given greater emphasis through a morphological analysis. Source: the author

A systems approach to meeting the challenges of urban climate change

Similar categories are identified in da Silva *et al.*'s (2012) systems approach to urban climate resilience. Three primary 'networks' were identified as significantly contributing to the resilience of a city or its parts. They are: 1.) Infrastructure networks (key physical and technological networks); 2.) Knowledge networks (structures that regulate access to information) and 3.) Institutional networks (rules and practices that govern human interaction). While the physical, political and social networks are arguably included in these categorisations, the economic network appears to be insufficiently represented. Da Silva *et al.* (2012) have placed the description of economic systems within the broader definition of institutional networks. However based on a review of the literature and data collected regarding flooding in Bang Bua Canal, emphasising the role of economic systems is crucial. Access to income is the lifeblood that allows people in a city to meet their basic human needs and requires analysis in its own right.

Figure 3.2.4c below illustrates how da Silva *et al.* (2012) organise their three networks. The box on the top (gray) indicates that a local government has direct control over what happens to its infrastructure, knowledge and institutional networks. Meanwhile, the box on the bottom (dotted lines) depicts an environment where a city has influence, not control, due to an increase in density of spatial and non-spatial dynamics (such as settlements, markets, policies and global networks) that operate within and outside of its administrative boundaries. Essentially the diagram shows that smaller scales of networks such as a district have more control than larger scales of networks such as a city.

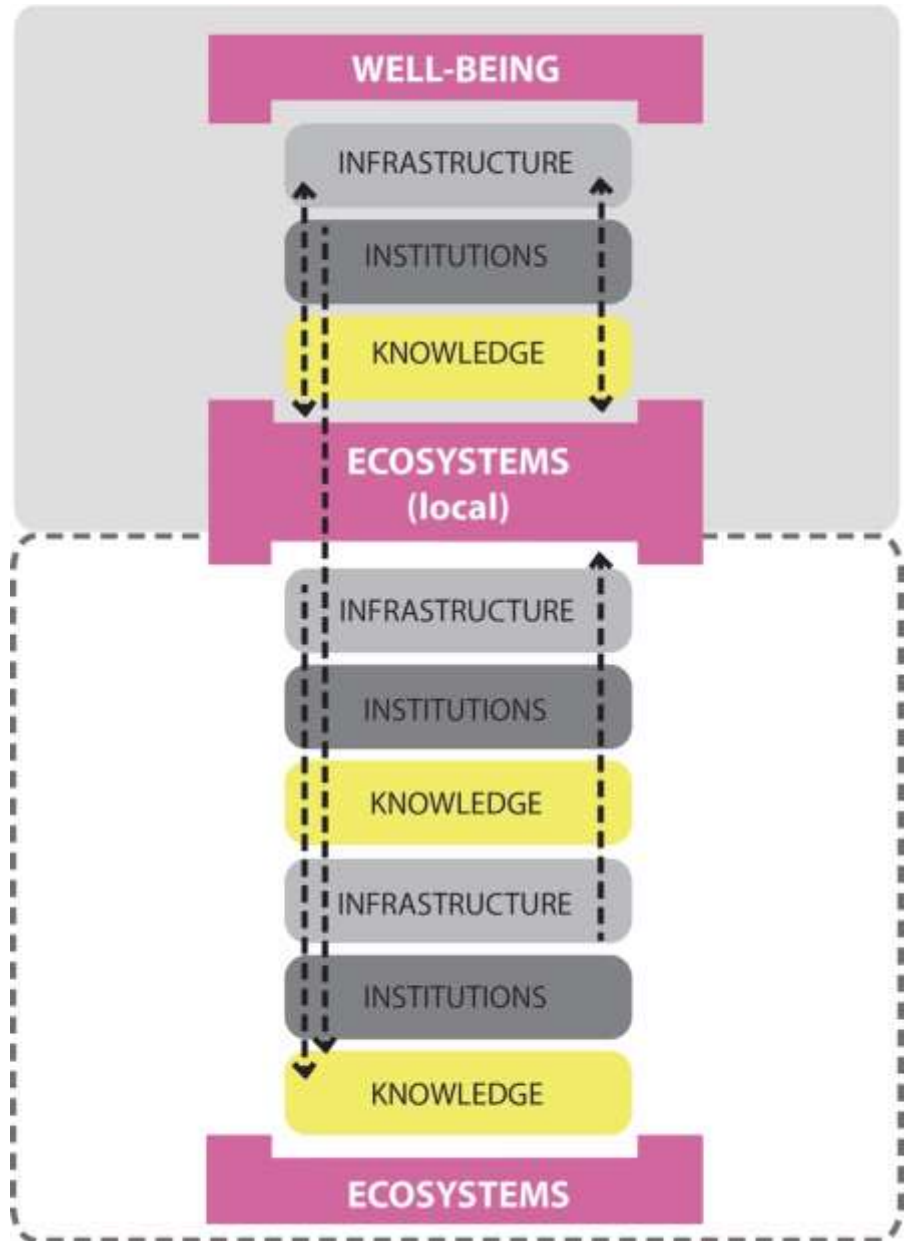


Figure 3.2.4c: An interpretation of da Silva *et al.*'s (2012) model of the city as an open system shows that smaller levels of governance i.e. a district, has a strong ability to control networks inside of its administrative boundaries (as indicated in the top gray box), and as the level of government grows in size i.e. multiple districts are under the control of a single authority, and a reduced ability to influence networks inside and outside of its boundaries is seen. Source: the author

City resilience framework

The City Resilience Framework developed by the Rockefeller Foundation and Arup (2014), can be viewed as an updated version of Arup's (2010) conceptual framework of urban climate change co-developed by da Silva. At the broadest level of the City Resilience Framework there are four categories that host 12 indicators, 48-54 sub-indicators and 130-150 variables that determine urban resilience.

The four categories in this framework consist of: 1.) Health and well-being, which focuses on the reduction of vulnerability, the increase of protection and livelihoods opportunities for people; 2.) Infrastructure and environment, which focuses on the quality of place; 3.) Economy and society, which focuses on financial flows and the organisation of society; 4.) Leadership and strategy, which refers to the way in which effective leadership and management occur, and how they empower people in cities. Figure 3.1.4 c below is a diagrammatic representation of da Silva's (2014) City Resilience Framework.

While the categories in da Silva's (2014) framework are grouped differently to the urban disaster resilience framework being developed by the author in this chapter, there are similarities. Both have a focus on the economy, infrastructure and the environment, social issues and governance. While the urban disaster resilience framework developed by the author uses similar concepts to the City Resilience Framework, the author's framework provides a greater emphasis on the built and natural environment by adding urban morphology, which is described in the next section.

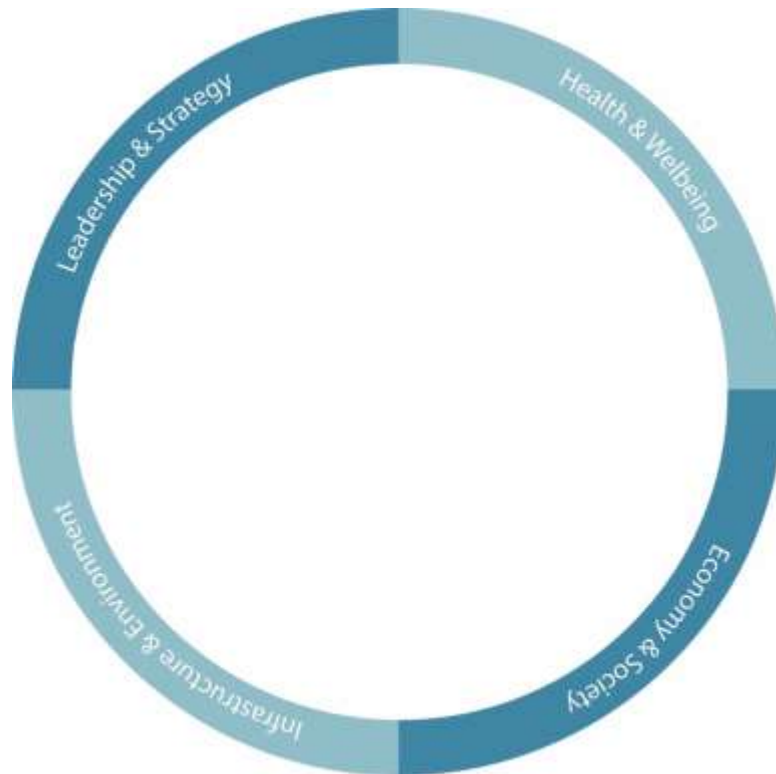


Figure 3.2.4d: An interpretation of The City Resilience Framework (da Silva, 2014). The four categories of urban resilience are highlighted in blue. Source: the author

Therefore, having explained the ways in which the author used urban resilience frameworks to develop the CAS component of this chapter's conceptual framework, the next section will explain the framework's morphological component.

3.3 Morphology: the framework's vertical axis

An urban morphological approach allows for analysis of the complexity and layered nature of the natural and built environment at multiple scales. Levine *et al.* (2012) argue that resilience lacks a historical dimension, and that is why mistakes are repeated. Morphology is a tool that can assist with understanding the historical transformation of a city and its component parts, especially in relation to the ways in which social, economic and demographic changes have influenced urban form (Bolio Arceo, 2012; Whitehand, 2012).

To this end, four morphological layers have been selected. The first is a topographical layer that investigates land and water in order to understand the implication of policy as well as longer-term transformations of topography over time. The second layer is that of movement networks and public open spaces, which investigates key CAS that influence change in roads, canals and public open spaces over time. The third, the plots layer, has been chosen to analyse the ways in which small or large parcels of land change over time in order to identify the key dimensions of CAS that have most influenced change at the plots layer. Lastly, the buildings and services layer was chosen in order to explore the ways in which buildings and access to services impacts upon disaster risk. These four layers were chosen based on the criteria of time and scale. Together they cover a range of scales from topography at the largest scale with the longest rate of change to buildings and services at the smallest scale with the shortest rate of change. The different layers across the range of scales create an understanding of the influence and power different actors have. Figure 3.3 is an illustration of the four morphological layers used in this framework.

The morphological layers comprise the vertical axis of the conceptual framework, and explains urban form components and traces changes in the spatial relationships between the built and natural form of a city over time (Kropf, 2009). The four morphological layers are used to investigate influences on the built and natural environment at different resolutions of scale (Moudon, 1997). Morphology can be used to understand how individual layers function as separate parts (Kropf, 2005), as well as in relationship to one another (Kropf, 2005) and in relation to the CAS on the horizontal axis of this framework. In the next section the four layers are explained in more detail.

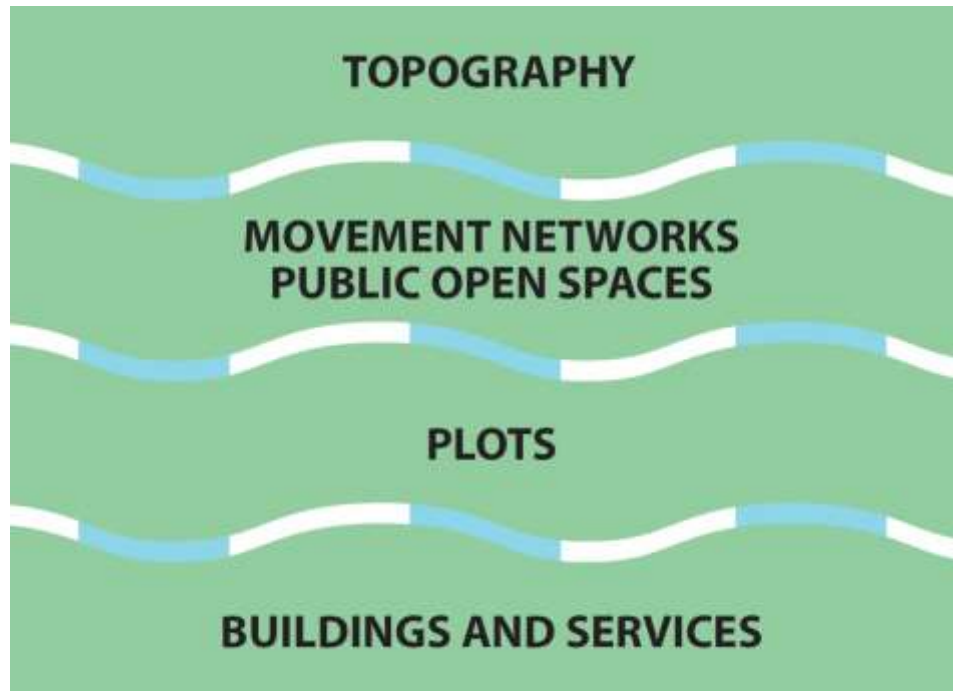


Figure 3.3: The four morphological layers used in the conceptual framework includes the topography layer; movement networks and public open spaces layer; the plots layer; and the buildings and services layer. Source: the author

3.3.1 Topographical layer

The topographical layer is comprised by natural landscape such as land, water and observable features of a specific terrain (Bolio Arceo, 2012). The topographical layer is investigated first because it is the largest, most permanent morphological layer where changes manifest across centuries (Bolio Arceo, 2012). Analysis of the topographical layer adds value by investigating the terrain and soil of pre-urban structures (Koster, 1998). Historical analysis of how human agents affect change at a topographical level can shed light on modern day challenges and opportunities related to quality of place (Bolio Arceo, 2012; Choi, 2011), and a subsequent need to investigate other morphological elements (Butina Watson and Bentley, 2007). The topographical layer is important in this framework because it accounts for changes in naturally occurring elements including, climate hazards and risks. Figure 3.3.1 below overlays the topographical layer with the economic, governance and social CAS.

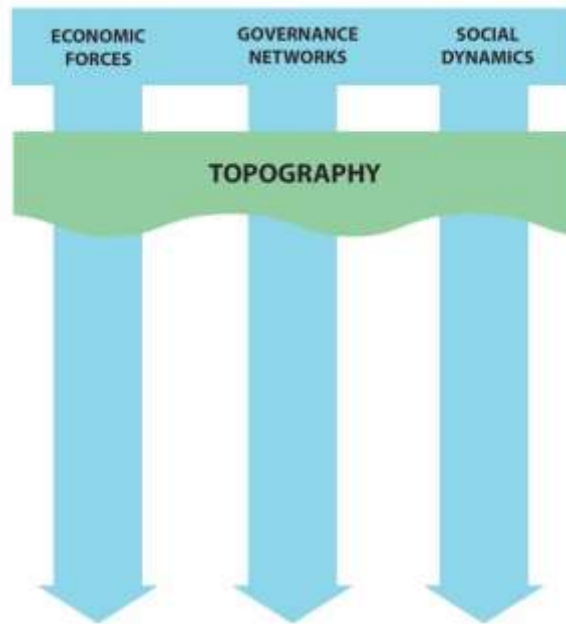


Figure 3.3.1: A visual graphic of the way in which the three key CAS intersect with the topographical layer. Source: the author

3.3.2 Movement networks and public open spaces layer

The second layer investigates movement networks and public open spaces. Movement networks are defined as mobility infrastructure such as streets, large highways and small as pedestrian lanes (Kropf, 2009) as well as water channels used for transportation, commercial activities or socialising (Truong, 2013). The design of movement networks impacts the safety and permeability of an area and increases legibility (Carmona, Heath and Tiesdell, 2003). Public open spaces are open spaces that are accessible to the general public and often host social and economic activities (Carmona, Heath and Tiesdell, 2003). Examples of public open spaces are informal market places, playgrounds, parks and squares. Public spaces ‘mirror the complexities of urban societies’; they can be impersonal, fragmented, contested or exclusive (Madanipour, 2010, p.1). Alternatively, when public spaces are accessible and inclusive (Madanipour, 2010) they can create a safe environment for strangers to connect and for friendships, cultural attitudes and identities to be strengthened. Public spaces tend to remain relatively stable in comparison

to plots and buildings (Butina Watson et al., 2004). Analysis of public open spaces within this conceptual framework focuses on how patterns of use have evolved over time, and the innovative trade-offs between private and public space (Dovey and King, 2011). This urban disaster resilience framework focuses on the use of movement networks and public open spaces in crisis and non-crisis periods; the types of people who use public spaces and the risks and opportunities involved. Figure 3.3.2 below illustrates the overlapping of economic, governance and social CAS with morphology's movement networks and public open spaces layer, as it is in these intersections where the interrogation of resilience takes place.

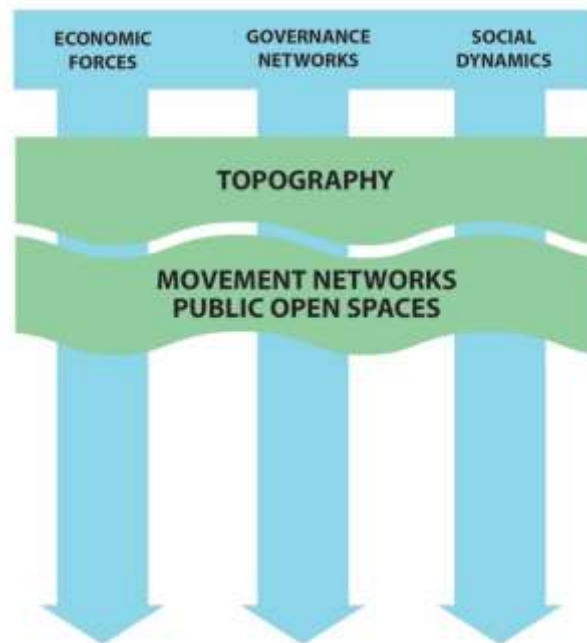


Figure 3.3.2: A graphic of the way in which the three key CAS intersect with the movements network and public open spaces layer. Source: the author

3.3.3 Plots

The third layer of analysis focuses on plots, used in this framework to identify changes in access to and quality of a piece of land, its use and ownership. Once street patterns have been established, plots begin to appear (Koster, 1998), hosting people settling or working on parcels of land (Whitehand, 2001). Plots are defined by land use and their physical form (Kropf, 2009). Streets in particular exert a long standing influence on

framing the way rural land is converted for urban use, which in turn influences the form of future plots through the residual elements passed down (Whitehand, 2001). This conceptual framework includes plots as a separate layer of analysis because it allows interrogation of land utilisation and mechanisms for securing tenure. Since plots are usually objects of ownership, analysis of ownership and control provides an essential insight into socially defined relationships between the controller and the user (Kropf, 2009). It is widely recognised that many towns and cities lack regulated plot dimensions (Whitehand, 2001), and thus they vary in shape and size. Examination of the plot layer can reveal patterns in the ‘neighbourhood effect’ where occupants influence one another by the type of changes they make to their individual plots, especially in areas of high density (Whitehand, 2001). In urban spaces where land is a scarce resource and land rights in informal settlements are frequently contested, it is important to analyse the use and access to specific plots of land – be they neighbourhoods or households. Figure 3.3.3 below illustrates the ways in which overlapping and interconnected economic, governance and social CAS intersect with the plots layer to create change over time.

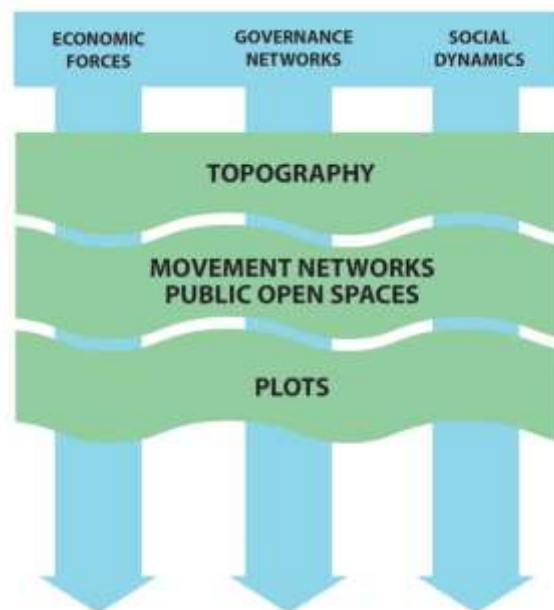


Figure 3.3.3: A graphic of the way in which the three key CAS systems intersect with the plots layer. Source: the author

3.3.4 Buildings and services layer

The final layer of analysis is that of buildings and services, the most rapidly changing of the physical layers, and arguably one of the most fundamental layers in morphological analysis for understanding the social, political and economic factors that influence a neighbourhood (Bolio Arceo, 2012; Whitehand, 1987). So important are infrastructure and services, that UN-Habitat describes them as the 'bedrock of prosperity' in its 2012-2013 State of the World's Cities Report (UN-Habitat, 2013b), arguing that 'inadequate infrastructure is a major impediment to the prosperity of cities' (UN-Habitat, 2013b, p.xvii). Building types have traditionally been mapped in order to ensure future urban development takes into account historical transformations and cultural traditions (Whitehand, 2001). While this is important, the main focus of analysing buildings and services in this framework is to ascertain opportunities for improving quality of life and well-being. According to UN-Habitat (2013b), access to adequate housing and residential services promotes competitiveness and economic growth; improves urban connectedness; reduces poverty and contributes to safer, more sustainable cities. Investing in, and maintaining critical infrastructure and services is listed by UNISDR (2015a) as one of ten essentials in its Making Cities Resilient campaign.

This layer of the framework provides an opportunity to identify the infrastructure that reduces flood risk, and maintains a basic mode of 'fail safe' functioning without complete breakdown in a disaster, one of the major criteria for measuring urban resilience (World World Bank, 2012a; Jha, Bloch and Lamond, 2012). Linking this particular layer with all of the other layers in the framework recognises that in a crisis, people who live in neighbourhoods rely on the city to maintain a low-level functionality of basic services such as power and water in order to survive. In non-crisis periods, people not only require access to working infrastructure, but also quality infrastructure that is affordable (Lucci, 2014). The buildings and services layer experiences changes faster and more frequently than any

other of the layers (Butina Watson et al., 2004). Figure 3.3.4 illustrates the ways in which overlapping and interconnected economic, governance and social CAS intersect with the buildings and services layer to create change over time.

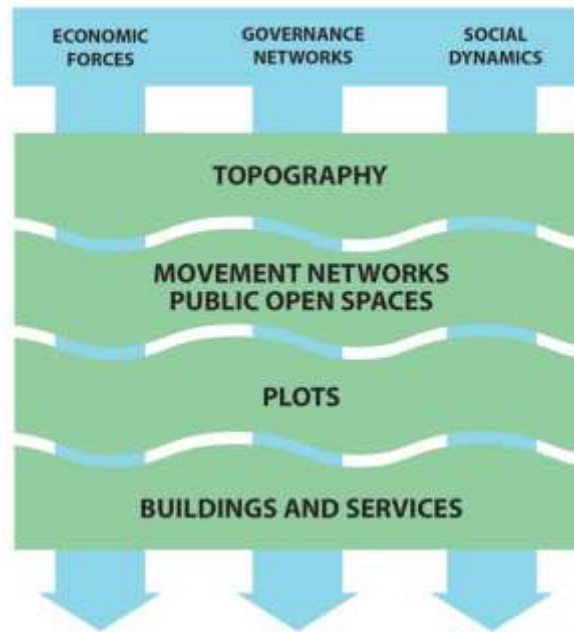


Figure 3.3.4: A graphic of the way in which the three key CAS intersect with the building and services layer. Source: the author

Having described the four morphological layers in this framework, the next section will explain how urban morphology and CAS approaches can be combined to create a single approach to analysing and understanding urban disaster resilience.

3.4 A conceptual framework for urban disaster resilience

This section explains how CAS and urban morphology approaches are combined to create a conceptual framework that investigates disaster resilience in order to identify key dimensions of resilience.

The urban disaster resilience conceptual framework pictured below in Figure 3.4.1 creates the image of a lattice with the horizontal axis representing three key complex adaptive systems and the vertical axis representing four morphological layers. A lattice structure enables analysis of the urban fabric to be conducted column-by-column, row-by-row. The blue horizontal axis represents CAS deemed most relevant to urban disaster resilience. The green vertical axis represents morphological layers used to analyse the quality of place in different layers of the built and natural environment.

The conceptual framework forms a matrix, whereby systems intersect with morphological layers, allowing data to be gathered and analysed across the two-way relationship. Complex interactions and feedback loops are deconstructed within the relationships in order to establish patterns of resilience, risk, vulnerability and capacity within CAS and identify key dimensions of resilience.

The dimensions of resilience are deemed positive or negative based on an analysis of power, in order to determine who is at risk, the types of risk they face and whether they need to adapt to or transform their situation. The key dimensions of resilience found within CAS are then allocated to the morphological layers they most influenced. The intersection between CAS and morphology is where dimensions of resilience are identified. Dimensions of resilience are points that indicate where human systems influence the built and natural environment and visa versa. The

dimensions of resilience may be positive for some, and negative for others, making it essential to couple resilience with transformation (Bahadur and Tanner, 2014).

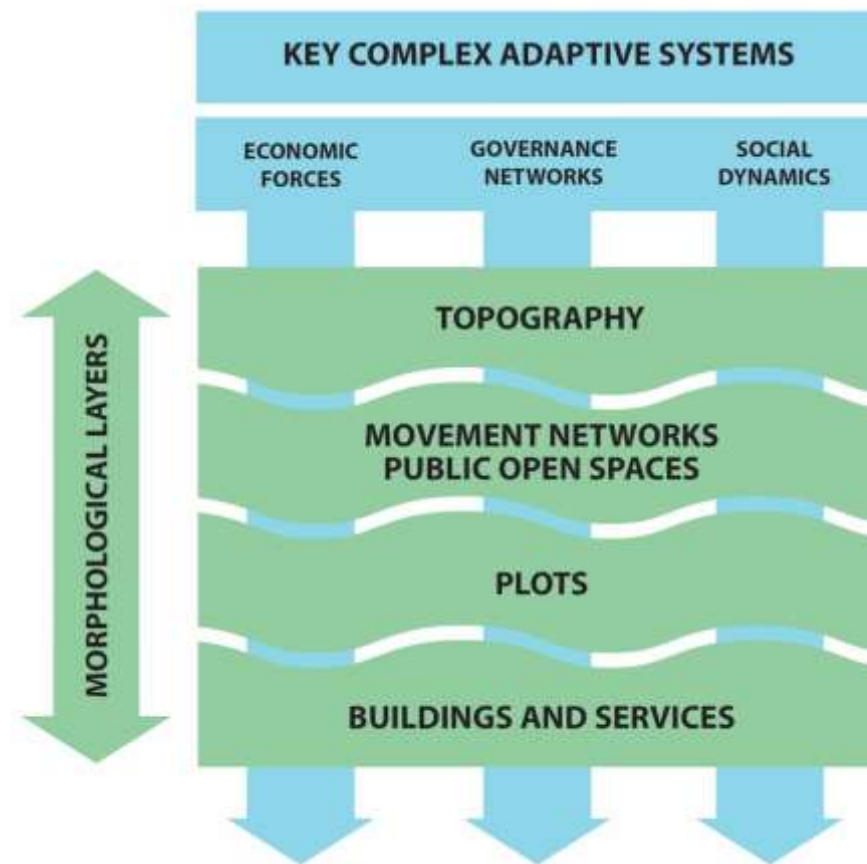


Figure 3.3.1: A conceptual framework of urban disaster resilience. The blue horizontal axis represents CAS deemed most relevant to urban disaster resilience. The green vertical axis represents morphological layers used to analyse the quality of place in different layers of the built and natural environment. Culled together into one framework, the intersections between human elements of CAS and morphological layers create dimensions of disaster resilience. Source: the author

3.4.1 Framework justification

This conceptual framework blends systems and morphology in order to investigate concepts of density, power, complexity and dynamism. Analysis of the morphological layers and their relationships with economic, political and social systems generates an understanding about the interactions that shape risk, opportunity and vulnerability in the built environment and the degrees of influence each of the systems have at

different physical scales. Moudon (1997) believes that reading the city and understanding its risks can only be done historically because its urban form components undergo continuous transformation.

Morphological analysis assists in understanding the city because it considers the transformation of form; resolution and time and can be correlated with factors that influence urban transformation (Moudon, 1997). Alesch (2005) writes that systems theory, the theory of complex self-organising systems, chaos theory, and urban morphology are a powerful and necessary basis for 'understanding systems we are trying to affect' (Alesch, 2005, p.3). In a paper that maps out a decade-long longitudinal study of more than a dozen disaster sites, Alesch (2005) argues that during disaster recovery, the built environment is rebuilt relatively quickly, but that the social, political, and economic relationships and capacities are not adequately addressed.

Bringing together theories of morphology and complex systems aims to provide a more powerful context analysis and a more accurate identification of the interaction of the built environment and the systems that influence it. This particular framework is different from other frameworks reviewed in this chapter because it combines morphology and CAS in order to understand resilience from a space-based systems approach in a way that no other conceptual framework known to the author does.

Moreover, the framework can be useful to a range of urban practitioners (i.e. urban planners and designers, engineers, architects, urban water management specialists etc.) looking to initiate activities that build resilience. It can be used to conduct a context analysis or a capacity and vulnerability assessment because it is holistic, comprehensive and easily adaptable. For example, if a local government wanted to build a road, they could use this conceptual framework to understand the social and

economic impacts of doing so. Or, if a neighbourhood wanted to change the way in which access to water occurs, the conceptual framework could also be used to map out the key social, economic and governance aspects that influence access to water at a range of levels from local to national.

In summary, the intersections between CAS and morphology provides a urban perspective on disaster resilience that combines a physical approach with a human approach to create a holistic analysis of the types of chronic stresses and disaster shocks people in a city face.

3.4.2 Analytical tool

The analytical tool, presented in Figure 3.4.2 below translates the conceptual framework into a matrix that can be populated with information from a range of scales – national, city, district or neighbourhood. It provides a way for practitioners to transfer theory into a practical tool by documenting patterns formed by CAS and plotting them on the morphological layer where the greatest amount of impact is seen. The tool can also be used to conduct a context analysis or a capacity and vulnerability assessment because it is holistic, comprehensive and easily adaptable.

As in the conceptual framework, the interdependent systems populate the horizontal axis and morphological changes in physical and natural environment populate the vertical axis. Once the user has decided on the scale of analysis, the next step is to identify the hazard. The title of the analytical tool 'Urban Disaster Resilience' is deliberately generic with the word 'disaster' interchangeable with a number of natural hazards. The next step is to fill in the boxes with analysis from the pairing of each of the categories.

The names of the complex adaptive systems in the horizontal axis have remained the same as presented in the conceptual framework, and are

accompanied by a short list of examples of the type of information that could potentially be included under each heading. For example, economic forces are defined as things that 'provide economic benefit such as money, markets, businesses, rent, jobs, savings, loans, credit, ownership and skills'. The governance networks are defined as involving 'the organisation of power and decision-making from local to national levels, such as governments, institutions, leaders, networks, planning policies and legal frameworks'. The social dynamics are described as including 'social interaction such as networks, social capital, discrimination, culture and values. The social section also includes social services such as education, welfare and healthcare.

While the essence of the categories and their definitions remain the same, the names of the morphological layers have changed to words that more colloquially communicate the concepts to people who do not have a background in morphological or systems approaches. Deliberately simple, but not simplistic, the names and descriptions reflect the kind of information that is intended to populate boxes. For example, the topography layer is described as 'land and water', and instructs users to input information related to historical and recent changes in the use of fields, rivers, lakes and other natural aspects.

The word 'plot' has been replaced with 'parcels of land' for users outside of Europe who may find the classification of plots is less frequently used. The 'movement networks and public open spaces' has been replaced with 'roads and public spaces' and defined as 'changes in access to and quality of roads and public spaces, including paths, playgrounds, parks and market squares'. The category of buildings and services has stayed the same because it was felt the name imbued the description, which is defined as 'changes in access to and quality of homes, community centres, shops, electricity, water and sewerage'.

Urban Disaster Resilience: An Analytical Tool			
Morphological Layers (built and natural environment)	Interdependent Complex Adaptive Systems		
	Economic Forces Provide economic benefits, such as money, markets, businesses, rent, jobs, savings, loans, credit, ownership, skills.	Governance Networks Involve the organisation of power and decision-making from local, to national levels; such as governments, institutions, leaders, networks, planning policies and legal frameworks.	Social Dynamics Include social interaction, such as networks, social capital, discrimination, culture and values. It also includes social services such as education, welfare, and healthcare.
Topography Historical and recent changes in use of fields, rivers, lakes and other ecological aspects.			
Roads and Public Open Spaces Changes in access to and quality of roads and public spaces, including paths, playgrounds, parks and market squares.			
Plots Changes in access to and quality of a defined piece of land and its use.			
Buildings and Services Changes in access to and quality of homes, community centers, shops, electricity, water and sewage.			

Figure 3.4.2 Analytical tool that uses the intersections of CAS and morphology to interrogate key elements of urban disaster resilience. Source: the author

Conclusion

This chapter explained the development of a conceptual framework that seeks to explore urban disaster resilience. It began with a discussion of the aim of the framework, which is to understand the relationships between the built environment and people in order to identify dimensions of resilience. It then discussed the two main components of the framework – CAS and urban morphology.

It was explained that based on the literature review in Chapter One, it was identified that economic, governance and social CAS are key systems used for analysing the city, and therefore these systems were chosen as categories for analysis along the horizontal axis of a matrix. The discussion highlighted that CAS interact with each other, but also within their own

component parts, such as land and housing, which have an inter-dependent relationship within the economic CAS. The CAS section then explained how the systems selected for this framework were triangulated with systems from other key frameworks, identifying where the author's framework aligns with current thinking and where it deviates.

The chapter then discussed the use of urban morphology to analyse the built and natural elements within a city at finer scales (referred to as layers) that captures the historical transformation of relationships between humans and the built environment. The four morphological layers included in the framework are topography; movement networks and public open spaces; plots and buildings and services.

This chapter ended by discussing that the culmination of the two urban approaches results in a framework for urban disaster resilience. A lattice is formed with CAS on the horizontal axis and layers of urban morphology on the vertical axis. The lattice assists with analysis of patterns of vulnerability, capacity, risk and resilience. Based on those patterns, dimensions of resilience i.e. activities and factors that help a neighbourhood better cope with and adapt to shocks and stresses, are identified. The dimensions can then be analysed through a lens of power in order to establish whether they are positive or negative by asking, 'resilience for whom and to what'. Once the dimensions of resilience are identified they can then be triangulated with findings from theory regarding development and disaster recovery.

Having described the development of a conceptual framework for urban disaster resilience, the next chapter will present the methodological approach for this research, including how the conceptual framework will guide the research.

Chapter four

Methodological approach

Introduction

This chapter addresses the question, ‘what is an appropriate methodology for analysing urban disaster resilience in low-income neighbourhoods?’ Firstly, it opens with an explanation of the meta-theories from which this research finds its grounding. Secondly, the overall research design is explained, including how each of the individual objectives have been met. Thirdly, a methodological framework is given for the types of data that were collected, the methods that were used for collection and the methods of analysis. Fourthly, a justification for utilising case studies is made, followed by an explanation of the case study selection. Fifthly, an explanation is given of how the analytical tool introduced earlier in Chapter Three assists with data analysis, specifically through the intersections between CAS and morphology. Sixthly, methods for validating the findings are discussed, first from the perspective of the case studies and then in terms of the generalisability of the conceptual framework. Finally, the chapter closes with an explanation of the strengths

and limitations of the study, and the ways in which the results will be disseminated.

4.1 Meta-theories

This section explains the research's inductive approach and its epistemological underpinnings in interpretivism.

4.1.1. Inductive research approach

This research takes a primarily inductive approach because it collects data with the intention of seeing what patterns emerge from it and what meanings can be extracted (Silverman, 2004). An inductive approach creates space for 'frequent', 'dominant' and 'significant' themes to be identified within the raw data (Thomas, 2006, p.238). For example, case study data has been collected and significant patterns within it have been identified.

4.1.2. Interpretivism

The epistemological position of this research is interpretivist. The research is positioned in the belief that reality is made and remade by people, and therefore subjective (Mason, 2005). Within the interpretivism perspective there are three layers of interpretation: the first when individuals perceive reality; the second when the researcher interprets an individual's perception of reality; and a third when the researcher's understanding is interpreted through the concepts and theories used by his or her discipline (Mason, 2005).

4.2 Research design

This section aims to explain the research design and its links to the five objectives described in the introduction of this thesis. A research design is a logical structure of inquiry; it is a plan that systematically links the research questions with the evidence that is collected and analysed (Yin,

2014). It differs from a research method, which is the modality through which data are collected. The logic of the research design is not influenced by methods from which data is collected (Yin, 2014).

This research design is qualitative. Yin defines qualitative research as, ‘a large body of research, embracing a variety of highly contrasting methods’ that study the meaning of people’s lives in real world conditions (2011, p.7). Based on the research question and aim, a qualitative approach was selected in order to explore, describe and explain urban disaster resilience through methods that are flexible, allow for data collection rich in detail and interpretive analysis that seeks to reflect participants’ perspectives (Creswell, 2007). The qualitative methods for research through a case study approach will be explained in the section 4.3 below.

The structure of this research is guided by five objectives set out in the introduction. Collectively, the five objectives enable an answer to the research question: What is an appropriate approach for understanding urban disaster resilience in low-income settlements? The research question is the driving force for this study and was formulated after analysis of the research problem (related to challenges with rapid urbanisation and the increase in frequency and severity of disasters in cities) presented in the introduction.

The first objective, to develop a conceptual framework for urban disaster resilience, was achieved through a literature review undertaken in Chapter Two, which resulted in a synthesis of systems and morphology approaches that formed the basis of the conceptual framework presented in Chapter Three.

The second objective, the development of a methodology, is developed and explained in subsequent sections of this chapter. The third objective, to apply the methodology to a case study, is carried out at a city-scale in

Chapters Five and Six (analysis of Bangkok), then again at a neighbourhood scale in Chapters Seven, Eight and Nine (analysis of three neighbourhoods).

Objective four, to propose dimensions of urban disaster resilience, is described in Chapter Ten, when key dimensions of resilience are identified. Objective five – to validate and revise the conceptual framework and key findings – is presented in Chapter Eleven when methods of validation are discussed. A graphic of the research design and process is shown below in Figure 4.2.

Having explained the research design and the ways in which the research objectives logically correspond with the chapters, the next section discusses the types of data required, methods for collection and methods for analysis.

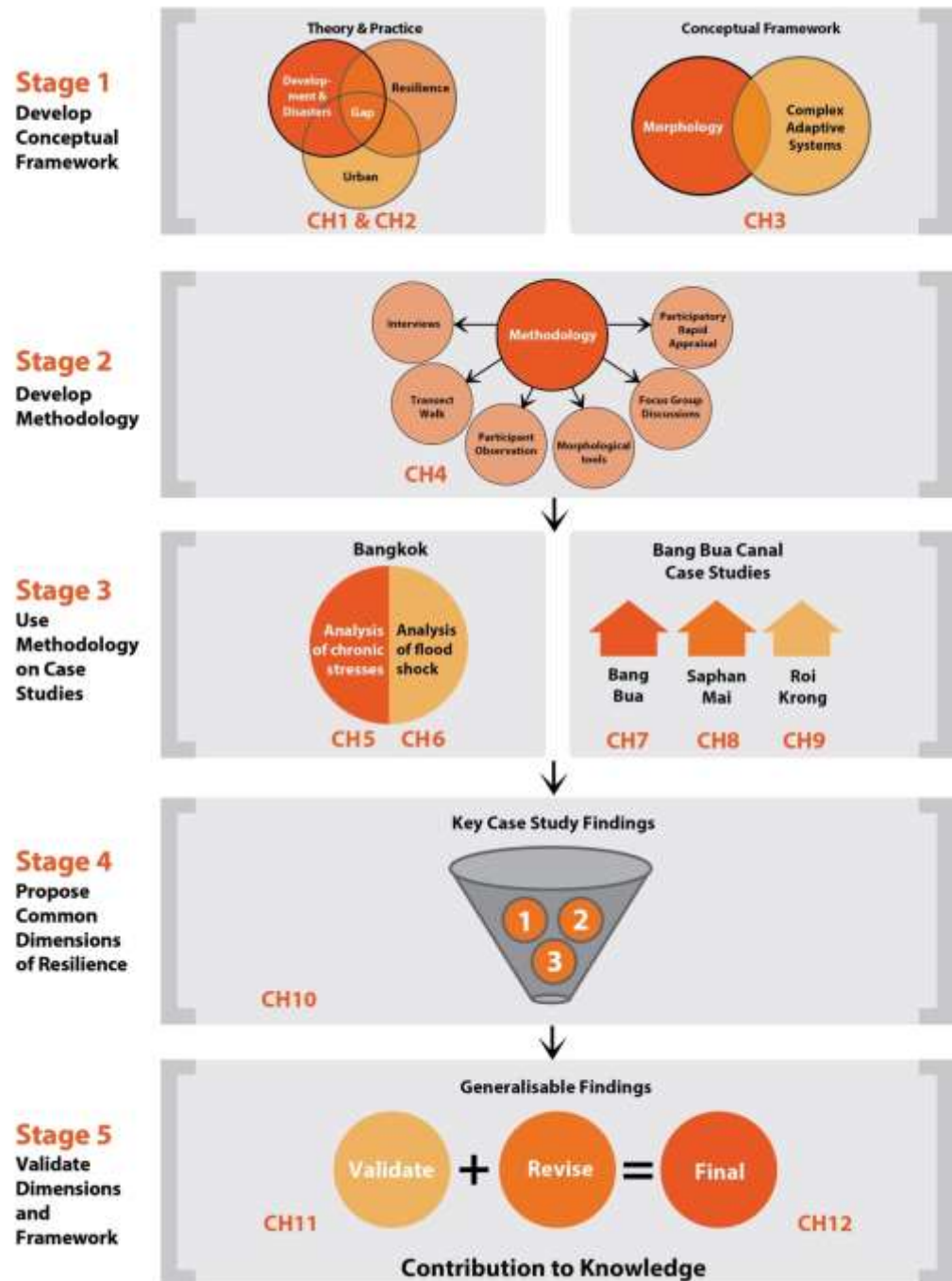


Figure 4.2: An overview of research design demonstrates how each chapter contributes to the fulfillment of a research objective. Source: the author

4.3 Research methods

This section explains the methodological framework used to explore urban disaster resilience within the case studies. Firstly, the required data types are outlined. Secondly, the methods for data collection are described and justified. Thirdly, methods of data analysis are explained.

4.3.1 Data types

Different types of data including visual data, documents and observations were used to triangulate information in order to confirm reliability (Bryman, 2008). Primary data (data gathered by the researcher) and secondary data (data gathered from other reputable sources, organisations or institutions) were used in the research. The types of primary information required included perceptions of risk, vulnerability and capacity. It also included perceptions of development and disaster related activities as well as relationships within the neighbourhood and external to the neighbourhood.

Secondary information gathered included maps that recorded public open spaces major and minor transportation networks, rivers and canals, land use, building use, flood impact and topographical/elevation levels. Photographs provided by neighbourhood residents who had recorded the flood and its impact were also analysed. Neighbourhood plans of housing registration, land sharing agreements, drainage and electricity lines as well as pedestrian lanes and alleyways were analysed. Housing models used to support the incremental home upgrading were also reviewed. In the case of documentation, three academic theses on the Bang Bua Canal were reviewed covering topics including, social capital and participatory upgrading (Archer, 2009); place making and participatory upgrading (Wungpatcharapon, 2012); and architecture for poorer urban people (Supitcha, 2010). Journal articles about the Bang Bua Canal were also analysed alongside a number of student research projects that were

published online. The author's notes from participant observations and journals entries were also included for analysis.

4.3.2 Methods of data collection

Six methods for collecting data were used, which were: 1.) participatory appraisal tools; 2.) semi-structured interviews, including those with key informants; 3.) focus group discussions (FGDs); 4.) workshops; 5.) participant observation; and 6.) journal entries. Table 4.3.2a summarises the types of methods and number of participants engaged in each. A summary of how each methods was used is explained below. A 'purposive sampling' approach was taken when selecting participants for the research with the aim of seeking samples of participants who will advance the goals of the research and assist the research question to be answered (Bryman, 2008).

1. Participatory appraisal tools

Many development and humanitarian actors favour participatory appraisal tools because of a 'bottom up' approach to data collection whereby local people are viewed as experts, and priority is given to their views and perceptions (Pretty et al., 1995; World Bank, 2013; Chambers, 1994). The key tenets are participation, flexibility, triangulation, and mutual learning between researcher and community (IFRC, 2007b). In order to gain an overview of each neighbourhood, the research used five participatory tools to collect spatial, social and political data, namely transect walks, household vulnerability assessment, timelines, historical profiling and Venn diagrams, each of which is explained below.

- a. Transect walk: A transect walk with neighbourhood residents allowed the researcher to observe a slice of each 'zone' or area of the neighbourhood to get a feel of the physical environment and the social relationships within in (Geilfus, 2008). One transect walk was done per neighbourhood, and was lead by local residents.

- b. Historical profile: A historical profile was used to track changes in the social, political, economic and physical context in order to shed light on causal links between the changes. Historical tracing asks individuals or groups to begin with current experiences and to go back in time (IFRC, 2007b). One historical profile was done for each neighbourhood, and was lead by local residents.
- c. Venn diagrams: A diagram of circles was drawn to represent different actors and their influence based on the size of the circle and its position in relation to other circles. The activity was used to understand relationships between actors and institutions as well as their similarities and differences (Chambers, 2002). One Venn was done by two leaders.
- d. Household vulnerability assessment: Used as a means for neighbourhood residents to self identify levels of vulnerability in the community through the collective creation of criteria (IFRC, 2007b), considering physical, social, economic and political aspects of vulnerability. One assessment was done for each neighbourhood with eight people participating overall.
- e. Timeline: Timelines were drawn to depict events that occurred in the 2011 flood. Participants drew a line on paper and indicated with words and pictures, the events that occurred during a specific time frame (Theis and Grady, 1991). One timeline was done for each neighbourhood with eight people participating overall.

2. Semi-structured interviews with key informants

Semi-structured interviews, where open ended questions are asked so that the issues raised by the interviewee can be followed upon (IFRC, 2007b), were used as a data collection method. Interviews covered broad topics including the history of the area, development processes that occurred before the flood and the types of activities that took place in the neighbourhood during and after the flood.

Semi-structured interviews were conducted with key informants. A key informant is defined in this research as someone who has an opinion or perception of the case under study (de Vaus, 2001), and can provide valuable information about the construction of their social reality (Bryman, 2008).

In total, 141 semi-structured interviews were undertaken. Of these, 50 were with key informants. Interviewees were drawn from one of the following six groups: aid agencies (international and local, UN agencies), 26 interviews undertaken; journalists, one interview undertaken; academics/think tanks, six interviews undertaken; business people, three interviews undertaken; the government (at various levels), nine interviews undertaken; and key people from each of the three case studies (four of the neighbourhood leaders were interviewed and categorised under the non-neighbourhood key informants list in order to protect their identity). A total of 91 semi-structured interviews were undertaken with people from the three neighbourhoods. A complete list of the key informants is included in Appendix A. The questions used in the semi-structures interviews are included in Appendix B. A sample of the interview transcriptions is included in Appendix C (the remaining transcripts are appended to this thesis in a CD). The literature review in Chapter Two informed the choice of key informants by identifying key groups of people who make decisions in the city and hold different degrees of power.

To protect the identity of key informants, a coding system was used. Neighbourhood residents from Bang Bua Neighbourhood for example have been coded 'BB' followed by a number e.g. BB1, BB2, BB3 and so on. The same system has been applied to key informants from Saphan Mai using 'SM' as the code followed by a number e.g. SM1, SM2, SM3 etc. and in Roi Krong the code used is 'RK' and a number e.g. RK1, RK2, RK3 etc. Non-neighbourhood key informants have been coded 'KI' followed by a number e.g. KI1, KI2, KI3 and so on. At times the neighbourhood leaders

are also identified as KI to protect their identity. The abbreviation is always accompanied by a descriptive titled that indicates the key informant's general background (such as government or aid agency) as well as their gender.

3. Focus group discussions

Focus group discussions (FGDs) are small groups of knowledgeable people who gather together to discuss a common theme (Creswell, 2007). FGDs can be more relaxed than one-to-one interviews, and are useful for checking tentative conclusions (Marshall and Rossman, 2011). In this research FGDs were used as a way to collect information and identify problems. In total, seven FGDs took place; five in the neighbourhoods (three in Bang Bua Neighbourhood, one in Saphan Mai and one in Roi Krong); one with a large lending institution and one with a local aid agency in order to explore key aspects of development work in the neighbourhoods as well as prevention, response and recovery during the 2011 floods. FGDs were also undertaken to validate findings (one FGD per neighbourhood, which will be discussed in section 4.6 (Methods of Validation) in this chapter). A sample of focus group discussion questions and transcripts are included in Appendix D. Transcripts of all FGDs undertaken can be found in the CD appended to the hard copy of this thesis.

4. Participant observation

Participant observation was used as a tool to gain a more complete understanding of the neighbourhoods and the relationships in them. PRA tools were used for data collection and analysis by engaging participants in activities that communicated opinions and perceptions, in order to identify key capacities and vulnerabilities. Conclusions reached through the use of other tools were triangulated with participant observation (Geilfus, 2008).

5. Workshops

Following the data collection and analysis, three workshops were held with 69 participants to validate the conceptual framework and accompanying analytical tool (described below in section with a range of actors, including urban professionals (planners, architects and real estate developers) academics and aid workers. The workshops aimed to validate the generalisability of the conceptual framework and analytical tool with other international case studies, and are discussed further in section 4.5 (Analytical tool) in this chapter.

6. Journal

A daily and weekly journal was kept in order to track activities, lessons learned and reflections about the research. A diary is helpful in identifying re-occurring themes.

Method	Number	Participants
Participatory appraisal tools (Clermont et al.) a. Transect walk b. Historical profile c. Venn diagrams d. Household vulnerability assessment e. Timeline	a. 3 (1 per neighbourhood) b. 3 (1 per neighbourhood) c. 1 Venn diagram d. 3 (1 per neighbourhood) e. 3 (1 per neighbourhood)	a. 6 neighbourhood leaders/upgrading leaders/committee members b. 9 older people in the neighbourhood c. 2 leaders d. 8 committee members and residents e. 8 committee members and residents
Semi-structured interviews	141	a. 50 with key informants b. 91 with residents
FDGs	7	58 residents (36 from Bang Bua Neighbourhood, 9 from Sapham Mai, 13 from Roi Krong)
Participant observation	Daily	Hundreds
Workshops	3 workshops	69 participants from 15 countries
Journal	Daily	N/A

Table 4.3.2a: A summary of the types of methods, number of participants and frequency of use (where appropriate).

4.3.3 Methods of data analysis

Two primary methods of data analysis were employed. The first method, morphological analysis, was based upon the four layers of morphology used in the conceptual framework (Chapter Three), namely topography, roads and open spaces, plots, and buildings and services. Morphological analysis assists with understanding the inter-relationships between social, economic, historical, cultural, political and spatial aspects of a city (Bolio Arceo, 2012). The methodology is inter-disciplinary and reflects that fact that a city can be 'read' by its physical form (Moudon, 1997). Moudon writes that urban morphology is a globally proven methodology that has been applied in North America and Europe, but has yet to be used more widely in other regions of the world (1997).

In this research, three key types of data were collected to assist with morphological analysis, namely maps, photographs and historical data. The types of maps included topographical, aerial, geographic information systems (GIS) and satellite imagery, which reflected the historical transformation of Bangkok, the recent upgrades of neighbourhoods in the Bang Bua Canal and the impact of the 2011 flood. Photographs were also collected. In particular, photographs of the Bang Bua canal and its houses before and after the flood were gathered, alongside photographs of the types of activities that took place during the three-month flood period. A range of documents were reviewed and analysed to construct an understanding of the historical context of Bangkok and the Bang Bua Canal. This included theses, government documentation (written policies and laws). Project reports, rapid assessments and programme evaluations from aid agencies were also analysed in order to understand gaps in the flood response and recovery process.

The second method of analysis used was coding using NVivo software, which facilitates in-depth qualitative data analysis. Categories for analysis were developed based on the conceptual framework. For example,

morphological categories (topography, movement networks and public open spaces, plots and buildings and services) and CAS categories (economic, governance and social) were created. Information that fits into those categories was coded accordingly. Information that did not fit into those categories such as who was the most vulnerable was coded into separate categories, such as 'most vulnerable' in this example. Analysis of key informant interviews, FGDs, journal entries, PRA activities, participant observations and workshop notes was undertaken using NVivo software. The coding was organised by neighbourhood, differentiating between pre-flood and post-flood data, with links between how one affects the other. The analysis sought to identify patterns and trends as well as links and causations.

Although the researcher speaks a basic level of Thai, additional translation was required to navigate the complexities of the research topic. Therefore, eight translators were hired to assist from a nearby local university in Bangkok. The translators asked interviewees questions in Thai and then translated their answers into English. Notes were then taken in English based upon the translation given and coded using NVivo software.

4.4 Case study approach

A case study approach has been selected in order to understand 'complex social phenomena' following a rigorous methodological design strategy (Yin, 2014, p.4). The case study approach is the primary methodology used for understanding urban disaster resilience in low-income settlements. The proposition for this research is that appropriate development investments in physical infrastructure and economic, social and governance systems will reduce disaster risk for low-income neighbourhoods. A case study approach highlights cases where the proposition worked and did not work while underscoring commonalities and differences in each case.

4.4.1. Rationale for using a case study approach

A case study approach is taken when analysis of the sum of all the parts offers a fuller, more complex understanding within a context than analysis of any of the single parts could offer on their own (de Vaus, 2001). In a case study, the primary question is how well the researcher is able to generate theory out of its findings; the secondary question is whether the findings can be generalised (Yin, 2003). Theory-building case studies begin with a question and a basic proposition, and then look at cases to establish a more specific theory, set of propositions or findings (de Vaus, 2001). Then, the conceptual framework will be revised based on the cases studied.

To these ends, three idiographic case studies were conducted to compare and contrast the unique features of each case based on the premise that the three case studies 'epitomise a broader category of cases' that are representative of the subject of enquiry (Bryman, 2008, p.56). Within the three cases there are many units of analysis at different levels, which makes it important to provide thorough descriptions that reconstruct the history of each case in order to lead to good explanations and a holistic analysis of the units (Yin, 2014). Case studies make use of a wide variety of data collection methods that best suit the different units of analysis (de Vaus, 2001). The criteria for judging the quality of a case study design includes construct validity (measuring a set of subjective criteria by using multiple sources and a chain of evidence); internal validity (matching patterns between cases); external validity (demonstrating how the findings can be generalised beyond the study); and reliability (showing how the study could be replicated) (Yin, 2014).

4.4.2. Identification of a case study city

This case study design involves the strategic selection of cases that use real world situations in order to understand urban disaster resilience. Some cases are selected because it is assumed they will provide support

for existing theories; others are chosen because they might disprove the proposition (de Vaus, 2001).

Criteria for selecting a case study city for this research included: the presence of development work; exposure to disaster risk; a disaster event having taken place in living memory; and the existence of disaster management policies and procedures. As a result Bangkok, Thailand's capital city was chosen due to the presence of low-income, vulnerable neighbourhoods engaged in poverty reduction work; the existence of disaster management laws and coordination mechanisms; the occurrence of the 2011 flood disaster; and the city's continued exposure to flood risk.

A map of Bangkok is shown below in Figure 4.4.2a. Informal settlements in Bangkok are host to everyday and chronic risks described in Chapter One – inadequate housing, no secure tenure, inadequate access to public services such as electricity and water and public infrastructure such as safe roads, public open spaces and health care facilities.



Figure 4.4.2a: A map of Bangkok, the capital city of Thailand. Source: the author adapted from the (Department of City Planning, 2014c)

Bangkok is a low elevation coastal city (Philip, 2011) and is a national economic hub (Center for Excellence in Disaster Management and Humanitarian Assistance, 2015). While it has been a mostly stable democracy, the city has had recent periods of civil unrest from 2006 when former Prime Minister Thaksin Shinawatra was ousted in a military coup (Peel, 2014) until the time of writing when a military government was in place having taken over government on April 15, 2015 (BBC News, 2015).

Bangkok has a strong civil society. According to the Asian Development Bank, 'Thai civil society is now varied and diverse, and coexists with strong constitutional guarantees of direct political participation, freedom of assembly, requirements for government consultation, and local determination of community rights' (2011, p.2). In 2007 the government enacted the National Disaster Prevention and Mitigation Act, which designates key roles and responsibilities for different government agencies in the case of a disaster. Bangkok also has high exposure to annual flood risk (World Bank, 2010). The city has experienced flooding in living memory, the most recent being the 2011 flood (Koontanakulvong, 2012). Exact numbers of local and international NGOs working in Thailand, and more specifically Bangkok, are difficult to come by as there is no mandatory centralised registration mechanism, but a small number of international aid agencies keep a presence alongside a wide range of civil society organisations (Asian Development Bank, 2011).

4.4.3 Identification of case study neighbourhoods

Three neighbourhood case studies were chosen in order to validate the basic proposition that good development builds disaster resilience. While all three neighbourhoods had been badly impacted by the 2011 flood, they varied in the degree of developmental gains obtained before the flood

occurred. The first neighbourhood was selected because it had experienced strong development gains; a second was chosen for having experienced some developmental gains. The third was chosen for having experienced little improvements.

The area where the neighbourhood case studies were undertaken is the Bang Bua Canal, located in northwestern Bangkok. Bang Bua Neighbourhood (Bang Bua is the name of the canal and also of one neighbourhood in the canal. To avoid confusion the former will be referred to as the Bang Bua Canal and the latter as Bang Bua Neighbourhood), Saphan Mai Neighbourhood and Roi Krong Neighbourhood are geographically located in a similar area – a three-kilometer stretch of land as illustrated in Figure 4.4.3a, and have been exposed to a range of economic, social and political development interventions.

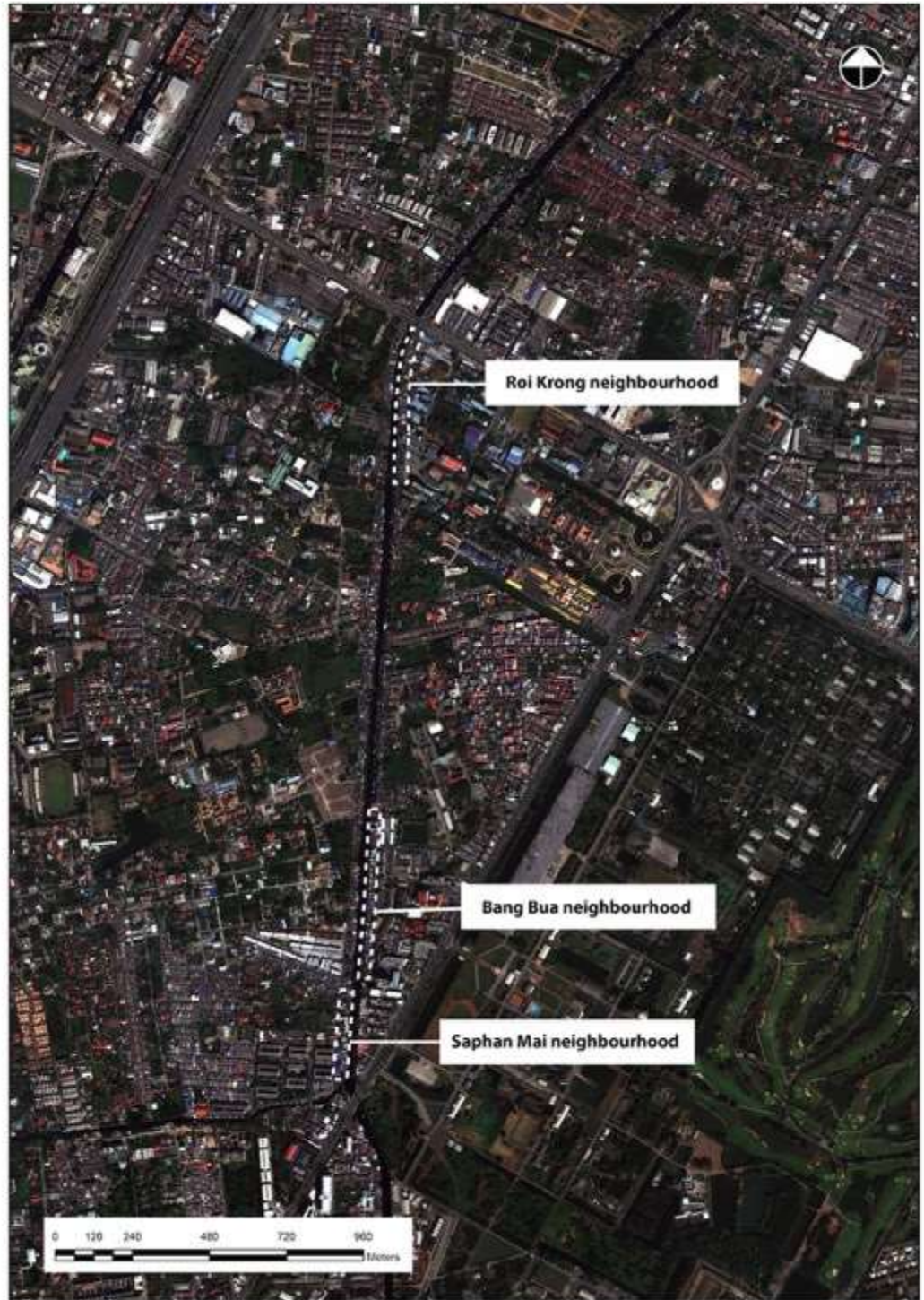


Figure 4.4.3a: A satellite image of the Bang Bua Canal in northwestern Bangkok. The three neighbourhoods chosen as case studies are located along a three-kilometre stretch of canal. The neighbourhoods are Saphan Mai, Bang Bua Neighbourhood and Roi Krong. Source: (Department of City Planning, 2014b)

Three neighbourhoods were chosen because they meet seven criteria developed for understanding disaster resilience in low-income neighbourhoods (listed in Table 4.4.3a below). All three neighbourhoods are deemed low-income (KI13, a senior member of an aid agency; KI14, a local aid worker KI37; a district government officer) based on the fact that most people earn less than two USD per day, meeting the first criterion. All neighbourhoods host informal governance structures associated with an incremental upgrading project (discussed in Chapters Five and Six), fulfilling the second criterion. The third criterion is that of informality, and all three neighbourhoods have been informal at one time, or are still regarded as so today. All three neighbourhoods fulfill the fourth criterion of having experienced a flood disaster in living memory when the 2011 flood impacted them. The fifth criterion of the presence of settlement upgrading is met through the existence of an upgrading programme that started in 2004. The sixth criterion of aid agency presence is met through the upgrading project. Finally, the criterion of having neighbourhood leaders present is fulfilled through formal government elections and informal leadership elections for upgrading. Table 4.4.3a below provides a summary of the criteria.

Neighbourhood Case Study Selection Criteria			
	Bang Bua Neighbourhood	Saphan Mai	Roi Krong
Low-income (less than \$2 per day)	X	X	X
Informal governance structures	X	X	X
Informal settlement	X	X	X
Flood disaster in living memory	X	X	X
Slum upgrading	X	X	X
Aid agency interventions	X	X	X
Neighbourhood leaders	X	X	X

Table 4.4.3a: Criteria for selecting neighbourhood case studies in Bangkok, Thailand. Source: the author

Using the above criteria, the researcher traveled to Bangkok in search of neighbourhoods to conduct the study in. She was introduced to the Bang Bua Canal through a university lecturer who had conducted thesis research there. The author made the decision to conduct her research in the canal due to a positive and welcoming response by leaders within the Bang Bua Canal and a perceived sense of trust between the researcher and canal leaders who agreed to participate in the research.

The following section gives a summary of the three case study neighbourhoods, starting with the Bang Bua Neighbourhood, selected for its strong development gains; Saphan Mai for its more moderate development gains; and Roi Krong for its lesser gains.

Case study one: Bang Bua Neighbourhood

Bang Bua Neighbourhood is well known for its upgrading success, and is often visited by other researchers as a study of good practice. There are 229 households, most of which have been reconstructed within three years based on a collaborative community vision and a series of land sharing negotiations amongst residents. The neighbourhood formed a legal cooperative and has a 90-year lease agreement on the land. Figure 4.4.3b below shows a photograph of Bang Bua Neighbourhood in 2014.



Figure 4.4.3b: A view of Bang Bua Neighbourhood. Source: the author

Case study two: Saphan Mai

Saphan Mai took approximately 14 years to reconstruct its 106 households. It has had modest development gains. Part of this community did not trust the upgrading process, entrenching it in a deadlock until the 2011 flood occurred and trust was built during the flood response. Since then, the remaining 45 homeowners have been granted access to loans to reconstruct their homes, resulting in an upgrading rate of 100 per cent. Saphan Mai is also a legal cooperative and has a 90-year lease agreement on the land. Figure 4.4.3c below shows a photograph of Saphan Mai in 2014 while upgrading processes were still underway.



Figure 4.4.3c: A view of Saphan Mai. Source: the author

Case study three: Roi Krong

Roi Krong has had the least development success of the three neighbourhoods. It is divided between those who participate in the upgrading scheme (approximately 40 per cent) and those who oppose it (approximately 60 per cent). The neighbourhood has 126 houses, and is a mix of affluent and low-income people. Opposition to the upgrading comes primarily from wealthy property 'owners' and those whose main source of income comes from room rentals. Many of the upgrading opponents say they are prepared to be evicted rather than give up income and land. Roi Krong has a cooperative but it is currently too small and too undersubscribed to be able to afford to rent the land. Figure 4.4.3d below shows a photograph of Roi Krong in 2014 where a small amount of upgrading had taken place.



Figure 4.4.3d: A view of Roi Krong (houses on the left). Source: the author

The author spent a total of seven weeks in Bangkok, between February 8 and March 29 in 2014. Fieldwork was undertaken sequentially in each of the three neighbourhoods: 14 days in Bang Bua Neighbourhood, 14 days in Roi Krong and 14 days in Saphan Mai with one week to follow up on gaps

in information from all three neighbourhoods. Initial contacts were made via a Thai doctoral graduate who had also done research in the Bang Bua Canal. To assist in data gathering, the author hired eight Thai researchers who assisted in note taking and in translation (while the author speaks Thai having lived in Bangkok previously, her level of fluency was not always sufficient). The schedule used for engaging the eight translators is included in the CD appended to this thesis.

4.5 Analytical tool

The data analysis was structured using the analytical tool presented in Chapter Three. The tool presents economic, governance and social complex adaptive systems across the horizontal axis and the built and natural environment into four morphological layers on the vertical axis. Data is then plotted on the matrix. The intersections between CAS and morphology identify dimensions of resilience. The tool can also assist with identifying patterns of strengths, weaknesses, opportunities and threats through the plotting of data. The analytical tool is shown below in Figure 4.5.

Urban Disaster Analytical Framework			
Morphological Layers	Interdependent Systems		
	Economic Forces	Governance Networks	Social Dynamics
	Provides economic benefit, such as money, markets, businesses, rent, jobs, savings, loans, credit, ownership, skills.	Involves the organisation of power and decision-making from local, to national levels, such as governments, institutions, leaders, networks, planning policies and legal frameworks.	Includes social interaction, such as networks, social capital, discrimination, culture and values. It also includes social services such as education, welfare, and healthcare.
Topography Historical and recent changes in use of fields, rivers, lakes and other ecological aspects.			
Roads and Public Open Spaces Changes in access to and quality of roads and public spaces, including paths, playgrounds, parks and market squares.			
Plots Changes in access to and quality of a defined piece of land and its use.			
Buildings and Services Changes in access to and quality of homes, community centers, shops, electricity, water and sewage.			

Figure 4.5: An analytical tool for understanding urban disaster resilience. Source: the author

4.6 Methods for validation

Findings were tested for validity on two levels. Firstly, specific findings regarding urban disaster resilience in the three neighbourhood case studies were tested through respondent validation, a process whereby a researcher provides respondents with an account of her findings and seeks to corroborate them (Bryman, 2008). One FGD was held in each neighbourhood to ascertain the validity of each set of case study findings. Eight to 13 men and women from each neighbourhood (including people in leadership roles) attended each meeting: eight men and five women in Bang Bua Neighbourhood; one man and seven women in Saphan Mai; and four men and eight women in Roi Krong.

Once validated, the findings in each neighbourhood were merged into a final list that was tested against the conceptual framework seeking to answer: are these findings representative of the theories and categories developed in the conceptual framework? This final check is that of internal validity, which seeks to match a researchers observations with the theoretical ideas they develop (Bryman, 2008). The conceptual framework was then adjusted based upon the evidence in the case studies. Table 4.6a below gives a visual depiction of the overall process and methods for validating findings specific to the case studies.

Findings on urban disaster resilience	Method of validation
1. Case study one: Bang Bua Neighbourhood	Focus group discussion in Bang Bua
2. Case study two: Saphan Mai	Focus group discussion in Saphan Mai
3. Case study three: Roi Krong	Focus group discussion in Roi Krong
4. Consolidated findings	Tested against the conceptual framework

Table 4.6a: A table listing the findings from each case study on the left and the method for validation on the right. Source: the author

The second level of testing focused on the generalisability of the conceptual framework and analytical tool. Testing the conceptual framework and analytical tool challenged the research's external validity by attempting to generalise, which can be difficult for 'qualitative researchers because of their tendency to employ case studies and small samples' (Bryman, 2008, p.377).

However, in an attempt to test generalisability, workshops were held with academics, urban professionals (urban planners and designers, architects) and aid workers to see how relevant and applicable the framework is for collecting and analysing information about urban disaster risk in cities around the world.

The validation process took place with 69 participants from 15 countries. Workshops were held with postgraduate students and staff in two universities (Oxford Brookes University (OBU), where the researcher is a student, and the Norwegian University of Science and Technology (NTNU), where the researcher was a visiting student researcher) and with one aid

agency (the British Red Cross, (BRC)), identified as an active urban focused humanitarian agency through the literature review in Chapter Two.

The two universities and the BRC are engaged in research and practice based activities related to development and disasters. Students were asked to apply the urban disaster resilience conceptual framework and analytical tool to their research and/or projects respectively which spanned across a total of 15 different case studies, 13 of which were linked to a development or disaster themes.

Table 4.6b below provides a summary of the institution where the validation process took place, the number of participants, the nationalities of the participants, the department represented by the participants and the case studies used.

Institution	Participants	Nationalities	Departments	Case studies
Norwegian University of Science and Technology (NTNU)	8 PhD candidates 4 Masters students 1 Teaching Assistant 1 University Professor	Norwegian Canadian British German Ethiopian Columbian Austrian Malawian	Architecture Planning & Urban Design Geography Urban ecological planning	IDPs in Nigeria Vanuatu cyclone Favelas in Brazil Conflict in Yemen IDPs in Kenya
Oxford Brookes University (OBU)	7 PhD candidates 16 Master students 5 Professors	Iranian British Filipino German Iraqi Indonesian Italian Brazil Kenya	Architecture Planning and Design Real Estate	Philippines typhoon Haiti earthquake Malawi floods Syrian refugees Norwegian fire disaster Bicycle lane planning Sustainability of non-residential buildings
British Red Cross (BRC)	27 people	Unknown	West and Central Africa, East and South East Asia, Middle East and North Africa (MENA), West Asia, Performance and, Accountability, International Law, Humanitarian Policy, Logistics, DRR, Health and care, Water and Sanitation	Haiti earthquake Philippines typhoon South Sudan conflict Other case studies unknown
Total	69	15	16	15

Table 4.6b: A summary of the participants engaged in the validation process, including the institution, participants' nationalities, department and case studies used. Source: the author

4.7 Dissemination of results

The results of this study will be shared with participants, and more generally with people who are interested in the topic of urban disaster resilience. Dissemination to participants will occur through different channels for different groups of key informants. Each key informant who has indicated on the consent form that they would like an electronic copy of the thesis will be emailed one. The thesis will ensure to preserve the anonymity of every individual interviewed. A summary of research findings will be translated and shared with neighbourhood leaders. Journals will also be targeted to disseminate the research more broadly. Journals such as *Environment and Urbanization*, *PLoS Currents: Disasters* and *Disaster Resilience in the Built Environment* journals will be pursued. Table 4.8 below summarises the types of products for dissemination in the left column, the groups that will be targeted in the centre and the method of delivery in the right column.

Product for dissemination	Target group	Method of delivery
Full thesis	Individual key informants who indicated on their consent forms that they would like a copy of the thesis	<ul style="list-style-type: none"> • Email soft copy • Hand deliver hard copy of a summary of research findings to neighbourhoods with assistance from translators • Dedicated research web pages such as ResearchGate
Journal articles (English)	Journals such as <i>Environment and Urbanization</i> , <i>PLoS Currents: Disasters</i> and <i>Emerald's Disaster Resilience in the Built Environment</i>	Submit articles

Table 4.8: The types of products for dissemination are listed in the left column, the groups that have been targeted in the centre and the method of delivery in the right column. Source: the author

The author presented tentative findings at a conference, 'Design for urban Disaster', held at Harvard University in May 2014, and was subsequently invited to submit a chapter for an edited book, 'Urban Disaster Resilience: New Dimensions from International Practice in the Build Environment', which is due for publication in the USA in 2016.

Limitations within the research are discussed later in Chapter 12, the concluding chapter, where the methodological approach of the research is reflected upon.

Conclusion

This chapter explained the methodological approach that was used to achieve the overall aim of developing a conceptual framework for understanding urban disaster resilience. By outlining a research strategy, this chapter aimed to answer the question, 'What is an appropriate method for analysing disaster resilience within low-income neighbourhoods?'

The chapter began with the meta-theories from which the research is grounded in. It explained the research is inductive because it collects data in order to extract patterns and meanings. It also explained that it is interpretivist, believing that reality is subjective because it is made and remade by people. The chapter then explained the research design as a logical structure of inquiry that systematically achieves the research objectives through the collection of evidence based on the research question. The research is qualitative in its design and is based on a case study approach that embraces many methods of data collection and analysis. The case study approach provides an opportunity to study real world conditions and the meanings people attach to their lives.

The chapter then explained the research methods used to understand urban disaster resilience. It highlighted the need for primary and secondary data to be collected through PRA, semi-structured interviews with key informants, FGDs, workshops, participant observation and journal entries. It then explained that data analysis was carried out through morphological analysis of physical data collected from sources such as maps, plans and observations of the built and natural environment. Coding, using NVivo software was also used to categorise economic, governance and social data.

The chapter then discussed the case study approach, underscoring that the case study was chosen because it allows for investigations of complex social phenomena. Moreover, it highlights where the proposition worked and did not work by analysing commonalities and differences within the data. The proposition in this research is that good development investments reduce disaster risk. Three neighbourhoods in Bangkok were chosen for study based on seven criteria, including that they were all affected by a flood in 2011, were all deemed low-income and had exposure to the same development opportunities with different outcomes. The three neighbourhoods were chosen because they were thought to both disprove and support the proposition.

The chapter then explained that an analytical tool was developed to compliment the conceptual framework. The tool assisted with data analysis by enabling data to be plotted on CAS and morphological layers. The intersections between CAS and morphology identify dimensions of urban disaster resilience. The chapter then explained the process of validating its findings. Validity was tested at two levels; first at the neighbourhood level through a focus group discussion in each neighbourhood in order to test the findings and second, the generalisability of the conceptual framework and analytical tool. The validation of the conceptual framework and tool involved 69 participants

from 15 countries. Workshops were held with two universities and one aid agency whereby the framework and tool were applied to 15 case studies. The chapter closed with an explanation of how the study results will be disseminated, in particular through journal articles, emailing the full thesis to key informants who wish to receive a copy and sharing a hard copy with the neighbourhoods delivered by the research assistants.

The next chapter analyses chronic stresses in the Bang Bua Canal using the conceptual framework introduced in Chapter Three.

Part III. Case studies analysis

Chapter five

A systems and morphological analysis of chronic stresses in Bangkok and the Bang Bua Canal

Introduction

This chapter uses the theories from the conceptual framework introduced in Chapter Three to conduct analysis of the historical transformation of everyday risks in in the Bang Bua Canal, specifically in the three neighbourhood case studies introduced in Chapter Four. As with the conceptual framework, this chapter is structured according to four morphological layers: topography; movement networks and public open spaces; plots; and buildings and services.

Firstly, the topography layer explains the Bang Bua Canal's historical transition from an agricultural history dependent upon regular flooding to a market-driven present day that attempts to contain natural flood processes. Secondly, the movement networks and public open spaces layer explains the historical transformations of streets, roads and other mobility networks influenced by economic opportunities and historical

political battles for power. Thirdly, the plots layer interrogates the dramatic ways in which neighbourhood and individual plots along the canal have changed through an incremental housing and land upgrading programme facilitated by a local aid agency. The final morphological layer, buildings and services, explains the role of informal activities and formal planning regulations that shaped housing density and access to services, amongst other things. Importantly, each layer interrogates the ways in which economic, governance and social systems influence the built and natural environment prior to the 2011 flood, essentially asking, what development activities reduced everyday risks?

This chapter therefore analyses the Bang Bua Canal and its struggle to exist in the face of eviction. The aim of analysing the canal's overall physical and natural environment in relation to economic, governance and social systems is to identify patterns of systemic vulnerabilities and capacities that contribute to building and reducing the impact of everyday risks.

Introduction to the Bang Bua Canal

The section of the Bang Bua Canal bordered by Phahonyothin and Chaeng Wattana Road (see Figure 5.0b), at approximately three kilometers long, is host to 12 neighbourhoods with an estimated population of 17,000 people (Wungpatcharapon and Tovivich, 2012b). Situated on the northwest side of Bangkok, the canal straddles the administrative border between Bang Khen and Lak Si district governments. There are seven communities in Bang Khen district and five in the Lak Si district. The map of Bangkok's municipal boundaries shown below in Figure 5.0a illustrates Bang Khen District on the right and Lak Si on the left. Figure 5.0b indicates the location of each neighborhood along the canal.



Figure 5.0a: A map of Bangkok indicating the location of the Bang Bua Canal straddles two administrative districts: Lak Si on the left and Bang Khen on the right. Source: BMA (Department of City Planning, 2013d)

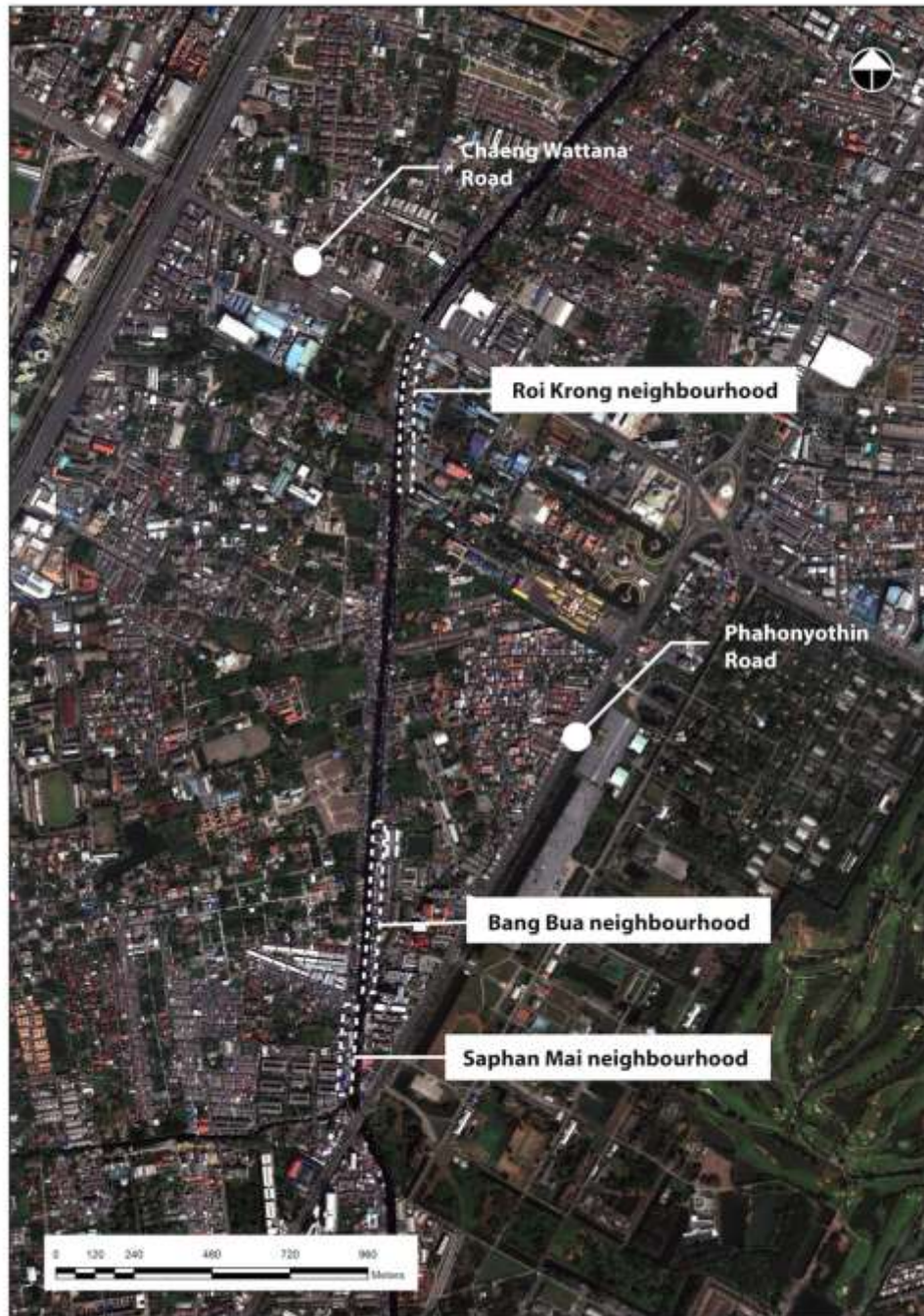


Figure 5.0b: A map of the Bang Bua Canal, depicting Saphan Mai at the bottom, Bang Bua neighbourhood in the middle and Roi Krong neighbourhood at the top. Source: (Department of City Planning, 2014b)

5.1 Topography layer

This layer analyses the natural landscape of Bangkok, seeking to demonstrate the ways in which the land and water have changed over time. The analysis aims to show that historical Bangkok has a topographical pre-disposition to flooding thereby creating a complex web of risk and exposure in present day Bangkok.

5.1.1 Agricultural economy

Bangkok is rooted in an agricultural past of rice farming (Roachanakanan, 1999), and became the capital of Thailand in 1767 (Webster, 2004). Much of the delta city is below sea level (World Bank, 2010), with some parts as low as -1.5 meters (Philip, 2011). This results in seasonal flooding, which was traditionally utilised in annual rice farming. In 1953 Bangkok covered 67 square kilometers, and the area where the Bang Bua Canal was located was surrounded entirely by rice fields (Roachanakanan, 1999). One elderly woman from Saphan Mai Neighbourhood recalls that in the 1950s land use was dominated by rice farming. She said, 'We were very poor when I grew up here. The rice farmers were rich. My father worked for one ... The walkways were mud. I used to take my shoes off a lot' (SM8, 2014).

The elevation map of Bangkok in Figure 5.1.1a below indicates elevation levels within Bangkok as low as -1.3 meters (lighter shade) and as high as 3.7 meters (darker shade). The Bang Bua Canal is historically less prone to flooding due to its location on the edge of the higher elevation zone.

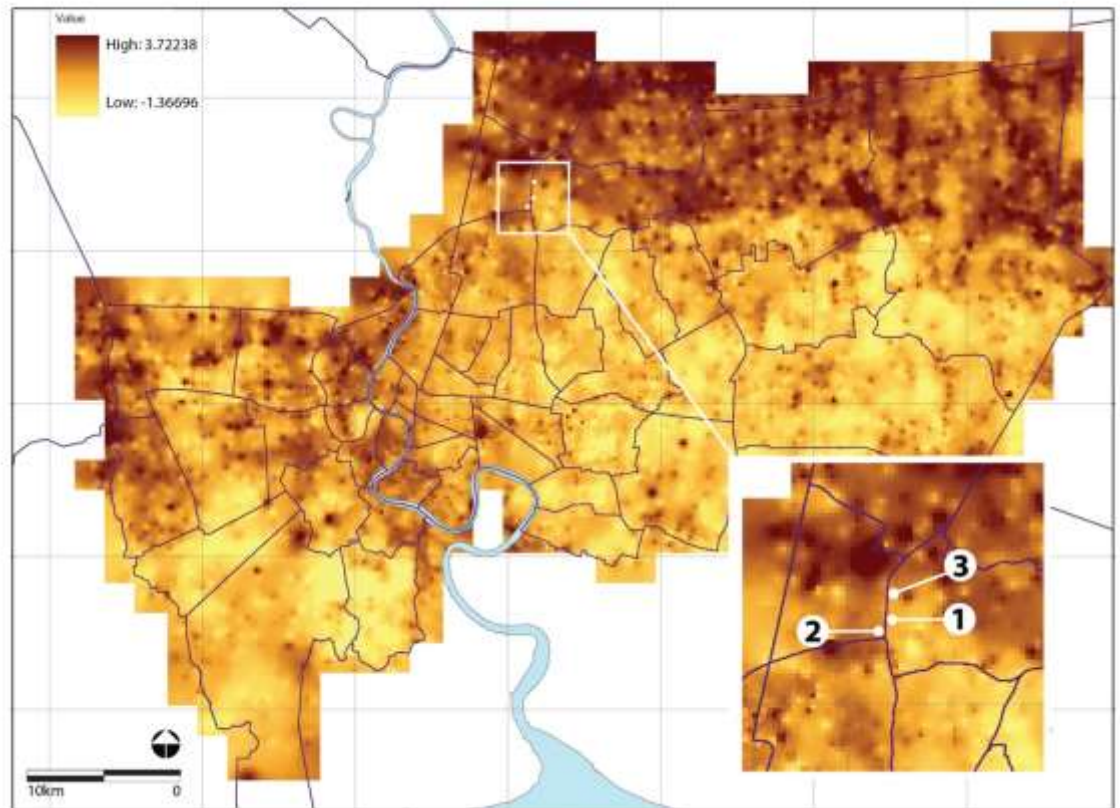


Figure 5.1.1a: An elevation map of Bangkok with the locations of the neighbourhoods depicted. Neighbourhood one is Bang Bua neighbourhood. Neighbourhood two is Saphan Mai. Neighbourhood three is Roi Krong. Source: (Department of City Planning, 2013a).

Throughout Bangkok's history, its canals were used in a variety of ways, such as, as a domestic water source, a method of irrigating paddy fields and as a means of transportation (Roachanakanan, 1999). In the 20th century, existing canals were maintained and new ones were built. In 1902, King Rama V established the 'Canals Department' to conduct canal maintenance for transportation and storage of agriculture products (Royal Irrigation Department, 2015).

In 1914, King Rama VI replaced it with the 'Barges Department' in order to focus on irrigation works (Royal Irrigation Department, 2015). Later, in 1927, King Rama VII focused on new canal excavation, water distribution and water pumping for cultivated land under the auspices of a new 'Royal Irrigation Department', which remained operational at the time of writing (Royal Irrigation Department, 2015). Over the years, new canals were accompanied by dikes and levees designed for flood prevention (Roachanakanan, 1999). The government map in Figure 5.1.1b below identifies canals that exist in present day Bangkok.

When Bang Bua Canal residents were asked to recall the historical ways in which they interacted with the canal and surrounding land for this research, older interviewees who were children between the mid 1930s to the early 1950s described a time when people relied on the canal for a daily subsistence diet of shrimp and fish (BB14, an elderly woman; RK29, an elderly man; RK31, an elderly man; SM17, an elderly man). The 1968 historical map of Bangkok in Figure 5.1.1c below reflects that the area around Bang Bua Canal was a primarily rural landscape with rice fields and forests. The black dots indicate few houses existed along the canals.

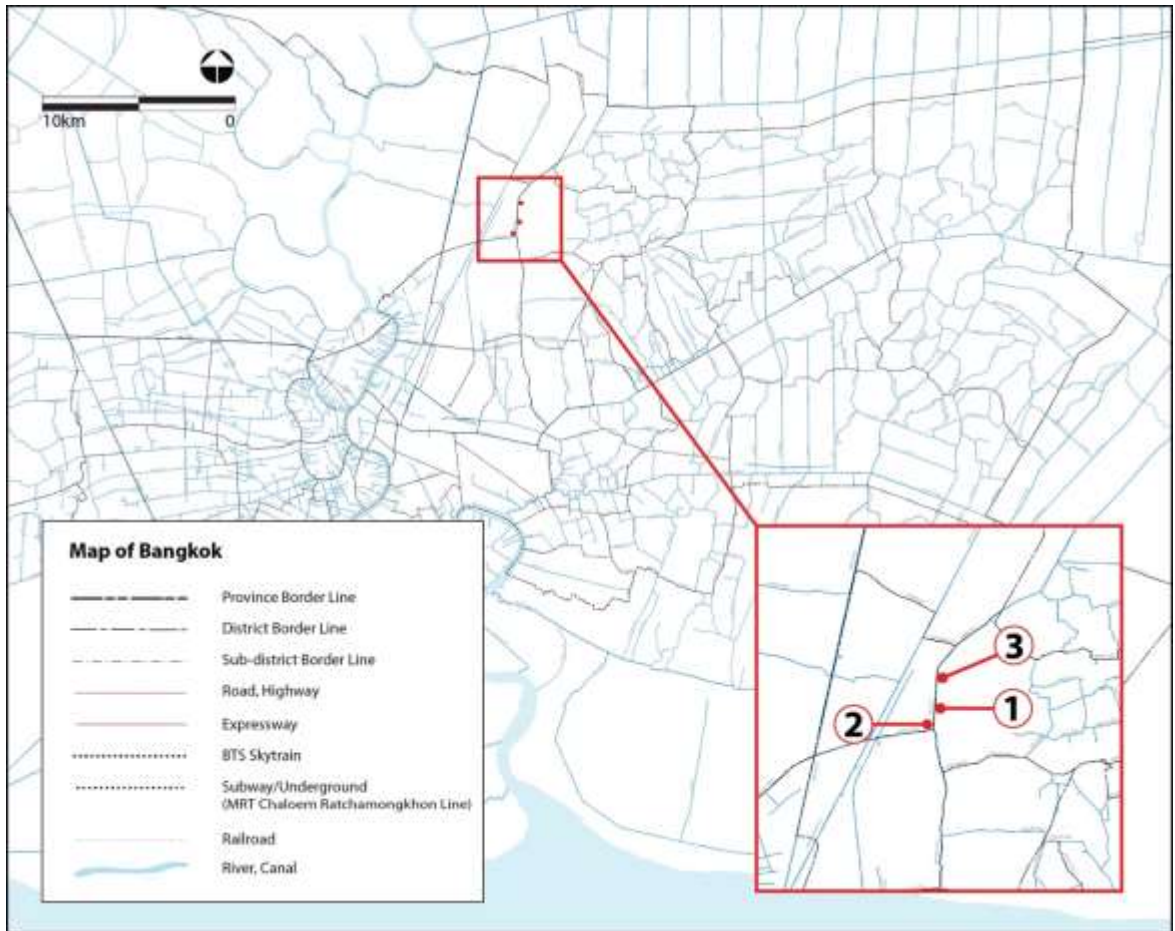


Figure 5.1.1b: A map of the rivers, canals and waterways in present day Bangkok. Neighbourhood 1 is Bang Bua. Neighbourhood 2 is Saphan Mai. Neighbourhood 3 is Roi Krong. Source: (Department of City Planning, 2013c)

The major roads and highways however, have remained the same as what is reflected on the 1968 map in Figure 5.1.1c below. During that time, people from provinces outside of Bangkok began to migrate to the Bang Bua Canal in search of jobs and an improved quality of life. An 88 year-old man from Roi Krong remembers moving to the area as a young child so his father could take up a job as a gardener at Phranakhon Rajabhat University that shares a property line with the canal (RK29). In more recent years, people evicted from other areas of Bangkok have also migrated to the area (Wungpatcharapon, 2012).

Modernisation and rapid economic growth accompanied by a lack of environmental regulations or the implementation of regulations left the Bang Bua Canal heavily polluted with large amount of rubbish lining the water, untreated sewerage and grey water draining into the canal as well as other toxic agents.

According to key informant interviews and focus group discussions with middle-aged and elderly people in the canal (BBFGD1, BBFGD2, BB1, BB13, BB9, BB10), the relationship between canal residents and the natural environment gradually changed; today it is no longer possible to rely on the canal for drinking or bathing water, nor is it safe to eat the fish or shrimp due to high levels of toxins. In a meeting with the central government's Ministry of Natural Environment, several community leaders (BBFGD1) identified 1989 as a point in time when they themselves realised the canal had become dirty, that buildings had overtaken the prevalence of rice fields and that subsistence food production stopped.

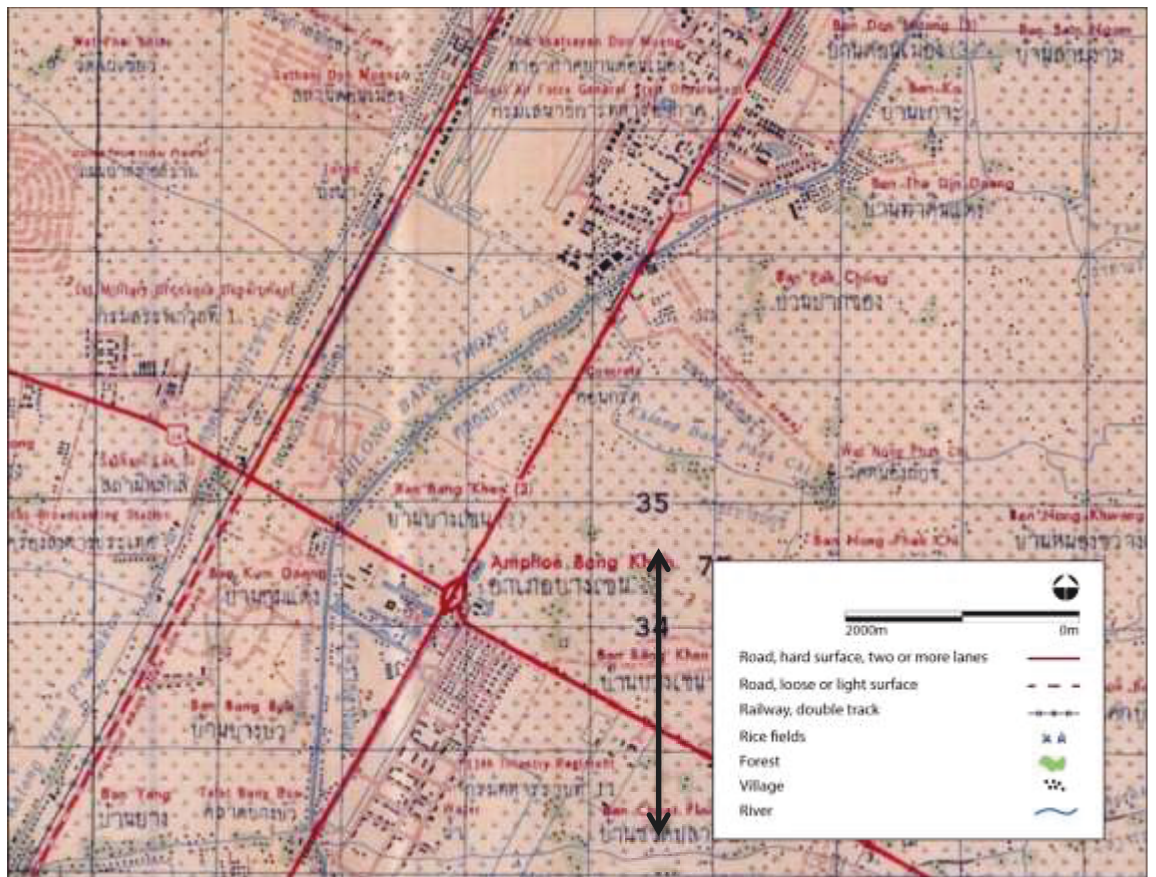


Figure 5.1.1c: A 1968 map of Bangkok reflects a primarily rural landscape with vast rice fields. Black dots indicate few houses existed along the canals, including the Bang Bua Canal. Major roads and highways have remained the same. A black arrow indicates the Bang Bua Canal. Source: (Royal Thai Survey Department, 1968)
Source: (Royal Thai Survey Department, 1968)

5.1.2 The politics of water management

Over the years, Bangkok's natural environment has been shaped by systems of governance networks that have increased exposure to floods. For example, a significant number of canals, historically built as transportation means, are now home to poorer people encroaching on canal banks or have been filled with land and turned into roads (UNESCAP, 2014). Urbanisation has decreased the percentage of permeable surfaces that can absorb rainfall. Decades of weak urban planning and lack of enforcement of land use regulations has led to uncontrolled growth of under-serviced neighbourhoods such as informal settlements (UNESCAP, 2014).

Upstream from Bangkok, integrated watershed management has been neglected; deforestation and wetland destruction has occurred, all of which impact the natural environment within Bangkok (UNESCAP, 2014; World Bank, 2012b). The shift from a primarily agricultural nation to a more industrial one has led to two competing water management challenges, namely water storage during the dry season and flood minimisation during the wet season (Haraguchi and Upmanu, 2014) in urban centres.

Water storage was particularly important to politics when in 2011 President Yingluck's Pheu Thai Party won the national election with a rice-buying subsidy scheme that eventually accumulated US\$4.46 billion (GBP 2.9 billion) in losses and President Yingluck's own impeachment in 2015 (Aljazeera, 2015; BBC, 2015a). The rice scheme saw the government purchasing rice from farmers at higher than global market prices, resulting in stockpiles of rice and damage to Thailand's rice exports (BBC, 2015b).

The rice scheme was significant because the Shinawatra family (Thaksin then his sibling Yingluck) has been in power since 2001, and are 'hugely popular among Thailand's rural poor, but are hated by an urban and

middle-class elite who accuse them of corruption and abuse of power' (BBC, 2015a, np).

Climate change, rising sea levels, coastal and soil erosion, as well as shifting clay soil are all modern ecological threats that suggest Bangkok's exposure to flood risk will continue to grow (Philip, 2011). Since the establishment of Bangkok, the city has faced exposure to high tides, storm surges, heavy rainfall and riverine flooding (UNESCAP, 2014). Bangkok's largest river, the Chao Phraya, decreases in depth as it moves downstream, which makes the land around it more prone to flooding (Haraguchi and Upmanu, 2014).

Urban growth and infrastructure has replaced former natural waterways and wetlands, and developers and planners alike have failed to prepare for persistent and reoccurring flooding (Philip, 2011). Moreover, Bangkok is a natural drainage basin for water running from the northern mountains towards the sea. Severe floods have been recorded in Bangkok since 1785 (Aon Benfield, 2012).

Table 5.6 below provides a list of historical floods compiled by the Bangkok Metropolitan Authority (BMA), which shows that flooding occurs frequently at a once-in-30-years and a once-in-10-years scale. The losses recorded are from within Bangkok alone and have not been adjusted for inflation or economic growth.

Year	Flood description	Economic Cost (THB)	Economic Cost (USD)
1785	4.25 meter flood height	N/A	N/A
1819	3.20 meter flood height	N/A	N/A
1831	Floodwaters reached the top of protective walls	N/A	N/A
1917	All roads underwater for at least one month	N/A	N/A
1942	1.50 meter flood height for two months	N/A	N/A
1975	Floods caused by tropical depression	1.1 billion	36.2 million
1980	Four days of excessive rainfall; widespread flooding	700 million	23.1 million
1982	Heavy rainfall prompts flooding	1.1 billion	36.2 million
1983	3-5 months of flooding due to multiple cyclones	6.6 billion	217.5 million
1995	Chao Praya measured 2.27 meters above sea level	3.0 billion	98.8 million
1996	Water levels reach 2.14 meters; dike overflowed	1.5 billion	49.4 million

Table 5.1.2: An adaptation by the author from the Bangkok Metropolitan Authority cited in Aon Benfield, 2012 of the historical flood events in Thailand. Source: the author

Thailand is exposed to a number of natural hazards, which as well as flood includes typhoons, tropical storms, landslides and tsunamis. Thailand's policy environment for disaster management stems from two key laws: the National Economic and Social and Development Board (NESDB) Act enacted in 1978 and the Disaster Prevention and Mitigation (DPM) Act enacted in 2007 (ADPC, 2013a; ASEAN Inter-Parliamentary Assembly, 2012).

The first law provides advisory services to the prime minister and cabinet on issues relating to social and economic development. The second law focuses on disaster management planning and response in Thailand through the establishment of the Department of Disaster Prevention and Mitigation (DDPM) under the Ministry of Interior. The DDPM has 18 regional centres and 76 Disaster Preparedness and Mitigation Provincial Officers, and works with policies created by the National Committee on

Disaster Prevention and Mitigation, which serves as the policy making body for disaster management, chaired by the Prime Minister and comprised of members from ministries and government agencies (ASEAN Inter-Parliamentary Assembly, 2012).

Gaps in the laws identified by the ASEAN inter-parliamentary Assembly in a report titled *Thailand: Country Report on Disaster Management (2012)* include a lack of specific operational procedures and holistic approaches to disaster management at all levels; a shortage of budget and basic equipment; a lack of research; a lack of integration and cooperation amongst agencies.

5.1.3 Social connectedness

After years of living alongside the Bang Bua Canal, a relationship of dependence by its dwellers on the natural environment grew. Although most of the neighbourhood key informants complained about the high levels of environmental pollution that exist today, a significant number of fish farms can be found in the canal and poorer respondents still supplement their diet with Morning Glory, a plant that grows within the canal.

When eviction threatened to break existing social connections a large number of people fought to stay in the canal, citing a sense of rootedness and belonging. As one middle-aged woman said: 'People don't want to leave the canal because for many of us our parents grew up here, and so did we. Years of memories were made here, and we don't want to leave those behind. We work here, take our kids to school here, and go to the temple here. We don't like apartment style living. We don't want to go' (BB2, 2014).

Memories also influenced the way people from the Bang Bua Canal perceive flood risk. Most people from the canal remember one flood in

the early 1980s that lasted for a few days. Since flooding has occurred only once in living memory, most people in the canal did not perceive flooding as a high risk before the 2011 flood.

The significant historical changes to land and water in the topography section demonstrate that Bangkok was built on an agricultural economy. Moreover, systems of governance created for managing water add an additional dimension of flood risk through the potential for human error. The analysis also showed that after decades of living next to the Bang Bua Canal, local people became dependent on the natural environment of the canal.

5.2 Movement networks and public open spaces

This section explores first the historical transformations of mobility networks and second, the evolution of public open spaces in the Bang Bua Canal. When examining the historical transformation of movement networks it is useful to start with the fall of the previous capital of Thailand – Ayutthaya. Ayutthaya, the previous capital city of the Siamese Kingdom that existed from the mid 14th to the mid 18th century, was attacked by the Burmese in the mid 1760s (Roachanakanan, 1999). After the fall of Ayutthaya, Bangkok became the new capital in 1767, prompting the need for greater municipal security and economic trade freedom. Investments in mobility infrastructure were henceforth made with the first railway introduced in 1893, a tram service in 1894 and motor vehicles in 1902 (Roachanakanan, 1999).

In 1895, a railway was built parallel with the Bang Bua Canal, and only two kilometers away from it (Roachanakanan, 1999). The line was used to transport goods and passengers from Bangkok to its northern cities, particularly Ayutthaya, the previous capital of Thailand. In 1914, the Ministry of Defense established the Don Mueang Airport, and its first air

defense (Roachanakanan, 1999), a mere six kilometers away from the Bang Bua Canal. In 1928 the airport served as both military and civilian infrastructure (Roachanakanan, 1999), and in 1952 the Don Mueang Airport became an international flight hub (Roachanakanan, 1999). Phaholyothin Road, the largest roadway built during the 1930s, was built in parallel with the railway and only two kilometres away from it (Roachanakanan, 1999).

The map in Figure 5.2a below provides a historical perspective of mobility networks in Bangkok in 1968. The railway line, Phaholyothin Road and Chaeng Watthana Road are annotated as 'hard surface roads with two lanes or more'. Small roadways with 'loose ground' are also indicated next to the railway line. There are two military bases, a university, a temple and an international airport nearby. As the legend indicates, much of the surrounding land was a rice field.

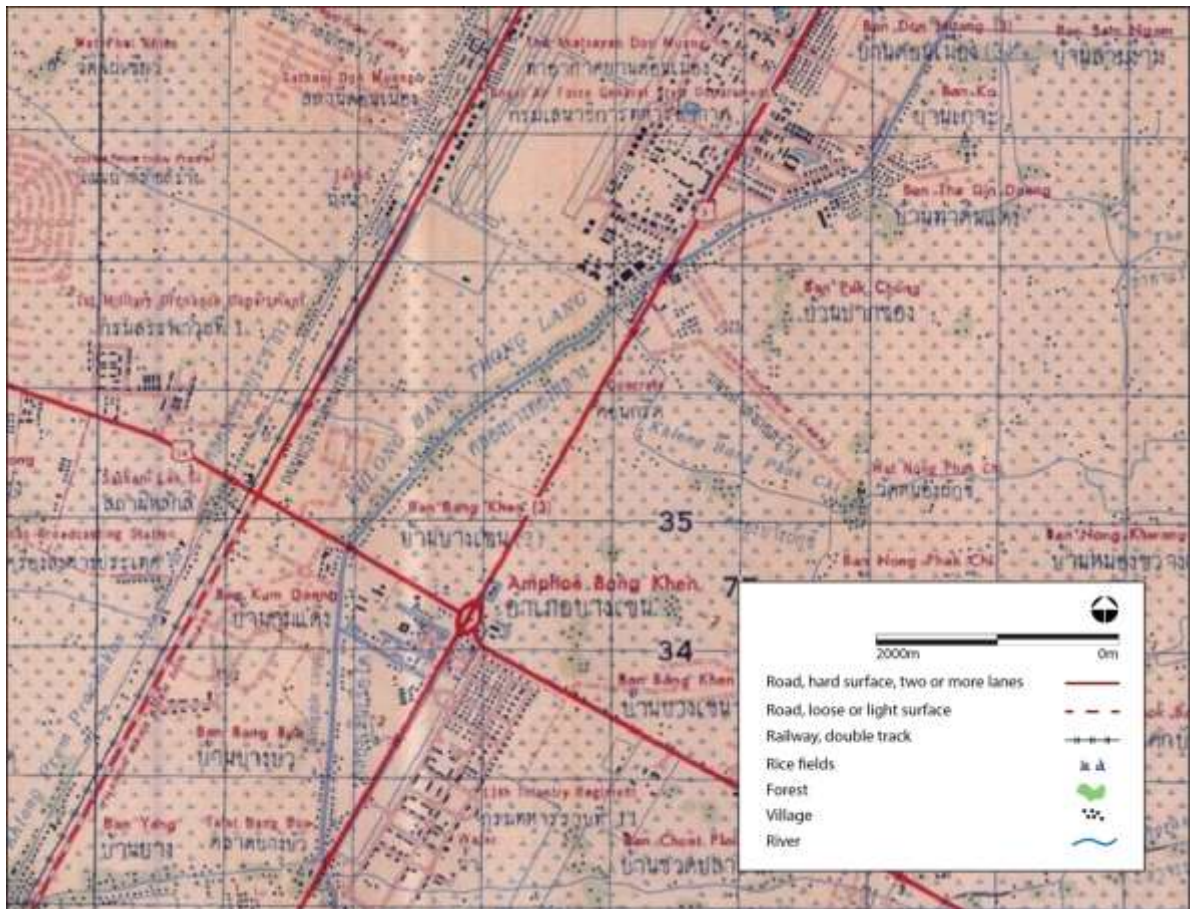


Figure 5.2a: A historical perspective of mobility networks in Bangkok. Rice fields are abundant amongst road and railway infrastructure. Source: (Royal Thai Survey Department, 1968)

Today, Bangkok can be divided into a street hierarchy of *thanons* (main streets), *sois* (side streets with vehicular access) and *troks* (pedestrian lanes) (Wungpatcharapon, 2012). Below is a photograph of Phaholyothin road, an eight-lane highway that crosses the Bang Bua Canal, shown in Figure 5.2b. Phaholyothin Road is the starting point for Roi Krong neighbourhood, barely two kilometres away from the airport.



Figure 5.2b: A view of Phaholyothin Road, an eight-lane highway that crosses the Bang Bua Canal. Source: the author

The focus of the mobility networks analysis is on pedestrian lanes, the only form of road within the Bang Bua Canal. The small pedestrian lanes in Bang Bua Neighbourhood are large enough to accommodate motorcycles. They are used for economic and social activities, and as is common with other such pedestrianised lanes in Bangkok, it is precisely here where 'hierarchy, ownership and access become ambiguous and the boundary between public and private becomes blurred' (Wungpatcharapon, 2012, p.24). The use of pedestrian lanes and street networks changes based upon time of day or night. The various appropriations and occupations of space create tensions between authorities whose job it is to enforce spatial law and residents whose economic and social life depends on such

fluidity (Wungpatcharapon, 2012). Below, Figure 5.2c shows a selection of photographs that illustrate the pedestrian lanes that run through the Bang Bua Canal. All of the lanes are narrow but are able to accommodate small motorcycles. Some of the lanes have humps to prevent motorcycles from moving too quickly.



Pedestrian lane in Bang Bua (case 1)



Saphan Mai back alley way (case 2)



Pedestrian lane in Roi Krong (case 3)



Pedestrian lane under Phaholyothin Rd. bridge (case 3)



General photo of roads in Bang Bua Canal



General photo of roads in Bang Bua Canal

Figure 5.2c: Types of roads within each neighbourhood. Source: the author

Public open spaces

From a historical perspective, spaces in cities have served as social meeting spaces to share information; market places to exchange goods and services; and connection spaces through city streets (Gehl, 2007). Carmona *et al.* write that public open spaces should link to movement networks, and are particularly important in dense environments because they offer recreational activities, host special events and are a place for a 'city to breathe' (Carmona, Heath and Tiesdell, 2003, p.188). In the Bang Bua Canal, public open spaces are used to share information and as market places. Two types of public open spaces common to the Bang Bua, and are discussed in this section – outdoor spaces connected to community centres and public open canal space.

The community centres have public open spaces connected to them for people to freely enjoy. In Bang Bua Neighbourhood there is some exercise equipment and a small statue for worship outside the community centre. However, most open space over the canal is primarily used for building houses, which is further discussed in the building layer section (5.4). Photographs of the open spaces connected to community centres and the canal are pictured below in Figure 5.2d.



Open public space at the Bang Bua Community Centre (case 1)



Open space under the orange tent roof in Saphan Mai (case 2)



Open space at a second community centre enclosed by a fence in Saphan Mai (case 2)



Development of new open space in the process in Saphan Mai (case 2)



Open space at the Roi Krong community centre (case 3)



Open space at the Roi Krong under a highway bridge (case 3)



Open canal space now occupied by housing (general photo of Bang Bua Canal)

Figure 5.2d: Photographs of the public open spaces that exist within each of the three case studies. Source: the author

5.2.1 A new international airport and economic opportunity

The Don Muang airport's global presence acted as an economic driver, rapidly populating the surrounding area with migrant workers, transforming paddy fields into highways and selling land for residential and commercial use. The areas around the Bang Bua Canal flourished with migrant workers looking for job opportunities that did not require specialist skill sets required to work in nearby factories, shopping centres, hotels, universities and the military. Today, many of those living along the canal are daily wage earners, such as vendors, labourers, shop assistants (Wungpatcharapon and Tovivich, 2012b), and to a lesser extent, government, military and office workers.

Many of the pedestrian lanes throughout the Bang Bua Canal used to be small, winding roads where economic transactions occurred (KI30, architect). Today the roads have been widened in two out of three of the case studies – in Bang Bua Neighbourhood and Saphan Mai Neighbourhood. The lane has become the backbone of the neighbourhoods with smaller alleyways connecting to it. Vendors are able to sell a range of food and non-food items on the main lane. Some residents use the area to store goods such as recyclable bottles and cans. Others store vending carts outside their homes and sometimes open for business, depending on the time of day. Vendors benefit from the temporary arrangement because they do not have to pay rent or tax (Wungpatcharapon, 2012). A selection of photos in Figure 5.2.1a, Figure 5.2.1b and Figure 5.2.1c below demonstrates the different economic uses of public open space.



Figure 5.2.1a: A vendor parks her tea and coffee cart on the pedestrian lane outside her home, and opens for business when customers arrive. Source: the author

Figure 5.2.1b: Bottles and other recyclable goods are stored on the pedestrian lane. Source: the author



Figure 5.2.1c: A vendor pushes a food cart through Bang Bua Neighbourhood (case study one). Source: the author

Public open spaces

Open public spaces have also been used for economic gain in the canal. For example, fish farms have been set up in various locations in the canal pictured below in Figure 5.2.1d. Others go fishing in the canal to supplement their daily diet as shown in Figure 5.2.1e. In Saphan Mai, open public space has been taken over by a restaurant that caters to residents as show in Figure 5.2.1f and Figure 5.2.1g. The NGO World Vision Thailand (KI17, an aid worker) donated the tent covering the public open space. While some neighbours contest the use of this space for personal gain (SM11, SM12, SM14), the community leadership appears to accept it.



Figure 5.2.1d: Fish farms are located against the canal wall on the right side of the photo. Source: the author



Figure 5.2.1e: Residents fishing along the canal to supplement their diets. Source: the author



Figure 5.2.1f: The public open space under the orange roof tent has been appropriated by a restaurant owner. Source: the author



Figure 5.2.1g: The open public space under the orange roof hosts a food stall. Source: the author

5.2.2 Political battles transform mobility networks and public open spaces

After the fall of Ayutthaya and the establishment of Bangkok as the new capital of Thailand in 1767, a greater need for municipal security flourished. By the 1930s Bangkok was a military town surrounded by paddy fields (Roachanakanan, 1999). In 1933 a coup was staged and troops took over the airport. After that a second military camp was set up a few kilometers from the airport. Railway lines combined with large roadways provided the air force with the ability to completely control access to Bangkok from the north of Thailand (Roachanakanan, 1999).

Public open spaces

As noted above, much of the open space around the canal has been taken over by housing due to a lack of enforcement of planning laws. Today, the Bangkok Metropolitan Authority (BMA) considers the space along the Bang Bua Canal 'open space' but recognises that due to complex power dynamics, they are not able to enforce the regulations. Figure 5.2.2a below is a map of open spaces in Bangkok, as determined by the BMA. The map outlines five types of open space categories of which the Bang Bua Canal fits into the category of 'open space for environment conservation along the roadside, riverfront and canal'.

When asked about the contradiction between the map and reality, one key informant from the BMA (KI4, 2014) said, 'We know slum dwellers live along the canals. We don't want them to stay. We try to remove them, but it's quite difficult. Elections play a big role in deciding the fate of the slums in terms of who stays and who goes.'

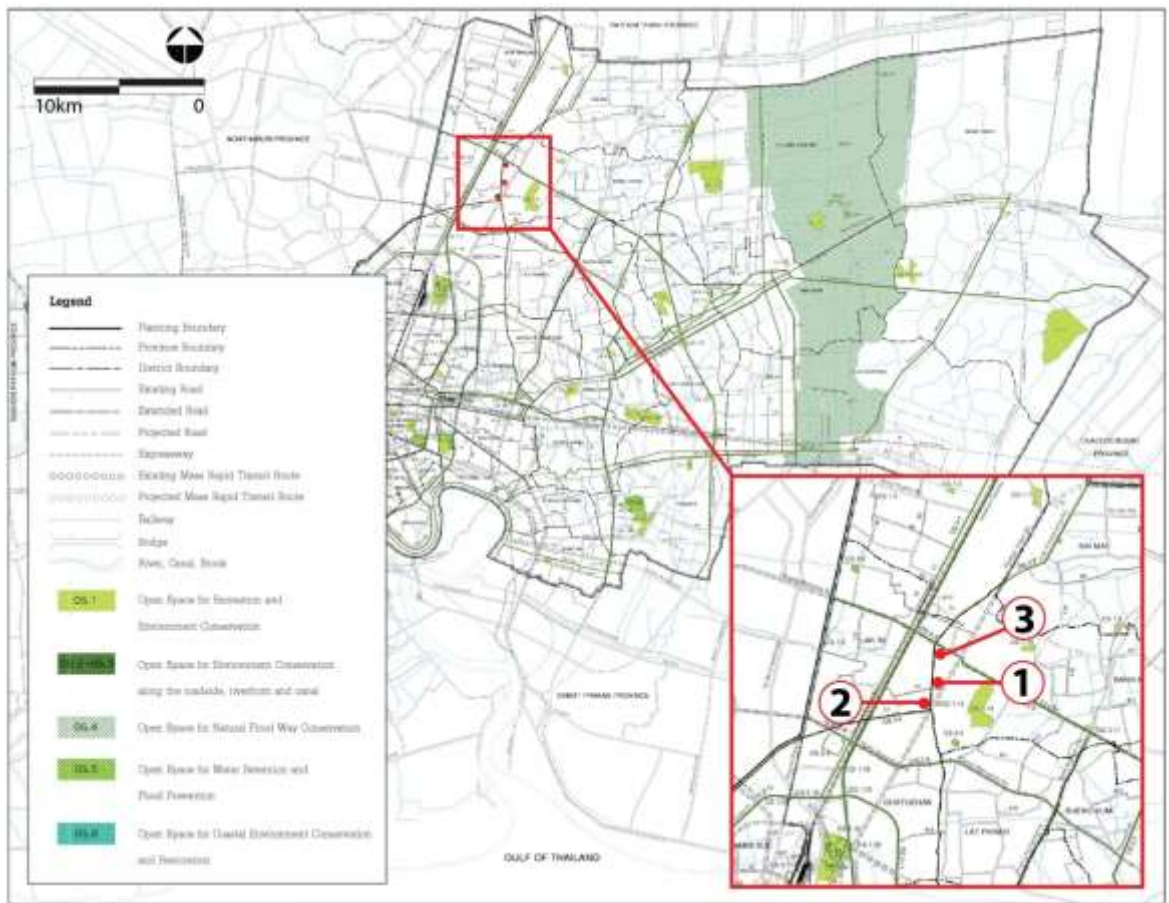


Figure 5.2.2a: A map of the official open spaces in Bangkok. The Bang Bua Canal is indicated on the map as open space, demonstrating the contraction between government master plans and reality. Neighbourhood 1 is Bang Bua. Neighbourhood 2 is Saphan Mai. Neighbourhood 3 is Roi Krong. Source: (Department of City Planning, 2013b).

Despite the Bang Bua Canal being categorised formally as open space, district governments offer services such as waste collection and canal maintenance to the neighbourhoods, regardless of their formal tenancy status. Figure 5.2.2b below shows a waste collection system in Bang Bua where district government boats collect waste on a weekly basis. Figure 5.2.2c shows government boats doing regular maintenance on the canals by clearing weeds.



Figure 5.2.2b: Waste removal services available in Bang Bua neighbourhood (case one). Source: the author



Figure 5.2.2c: Canal maintenance services provided by the government. Source: the author

5.2.3 Social grounds for information sharing

The pedestrian roads in the canal are places where social activities take place. For example, sometimes open spaces have been occupied for private use as outdoor sitting areas with a placement of a bench or even a couch, as picture in Figure 5.2.3 below. Residents also use the small lanes for parking their motorcycles on a temporary basis when they visit on another, which can also be seen in Figure 5.2.3. Over the years, improvements in the roads in the canal have led to a reported increase in safety and security as well as a reduction in conflict.

Key informants from Bang Bua Neighbourhood also reported a significant decrease in the amount of drugs being traded in the area (BB3, a middle-aged woman; BB11 an elderly woman). While other factors may have

influenced the perceived decrease, lighting and a more open public view of the roads were thought to play a role. The photo in Figure 5.2.3 below also shows lighting, humps to slow motorcycles down and loud speakers to make public announcements.



Figure 5.2.3: Pedestrian roads in Bang Bua Neighbourhood are places for socialising and for temporarily parking motorcycles. Lighting, humps and loud speakers contribute to overall safety. Source: the author

Public open spaces

Socialising and information sharing also occurs in open public spaces in the canal. For example, in the open spaces around the community centres people gather formally and informally. Sometimes while a meeting is taking place in a community centre, there are others meeting in the open space for private conversations. The playground area where adults go to watch their children play is also an important area and time of day for information sharing.

5.3 Plots

This section seeks to explain how a decade of incremental settlement upgrading transformed neighbourhoods and individual plots through a national Baan Mankong's national 'secure housing' scheme.

People who live next to the Bang Bua Canal have been squatting on land owned by the National Treasury Department (Wungpatcharapon and Tovivich, 2012b). Long-term canal residents (BBFGD1, BBFGD2, BB1, an elderly man, BB2, an elderly woman) spoke about a time in the early 1960s when people began illegally buying, selling or squatting on plots of land around the canal. The landowner, the Thai Government's National Treasury Department, was unable to retain control over the sprawl of houses that sprung up.

According to canal residents, rumours of eviction started in the late 1990s, but the most serious threat came in 1999 when the government announced plans to build a new road through the area. In a focus group discussion between neighbourhood leaders within the Bang Bua Canal and the National Department for the Environment (BBFGD1), canal leaders explained that houses built on the canal bank were blamed for flooding in areas nearby. Neighbourhood leaders explained that embankments in some areas were collapsing, causing the canal to become shallower, and

with permanent homes on the canal bank it was impossible to dredge and clear the canal (BBFGD1). Leaders also cited increasing levels of water pollution due to the practice of dumping untreated sewage and household wastewater directly into the canal as another reason given for eviction (BBFGD1).

Essentially, the canal was viewed as a 'slum' with a widespread drug trafficking problem (KI15 district government; BB2, a middle-aged woman; KI30 professor). Gambling, an illegal activity in Thailand, was also a main feature of life (BB2 a middle-aged woman; BB20, a middle-aged woman; BB1, an elderly man). One middle-aged man reflected that, 'this canal was a ghetto that nobody wanted to come to, but now the houses look better so people aren't afraid to come here' (BBFGD1, 2014).

Having explained the historical transformation of the plots, the following section will illustrate more recent activities that have transformed the plots layer starting with the introduction of a neighbourhood savings structure.

5.3.1 Neighbourhood savings structures and plot transformation

Ultimately, the neighbourhoods in the Bang Bua Canal avoided eviction by joining Baan Mankong, the national government's long-term solution to complex land and housing for poorer urban people (Wungpatcharapon and Tovivich, 2012b; Boonyabancha, 2005). The Baan Mankong programme successfully advocated to the Bangkok Metropolitan Authority that settlement upgrading instead of eviction was in the best interest of canal residents and the city itself as long as the following three conditions were agreed to: land rental was paid; houses move off the canal bank and onto proper land; and environmental pollution was reduced. The programme helps neighbourhoods upgrade through the provision of low interest infrastructure subsidies as well as housing and land loans to neighbourhood cooperatives.

The national government's implementing partner, the Community Organisations Development Institute (CODI) is responsible for facilitating the upgrading process by setting up mechanisms that build trust and form a system of accountability (Boonyabancha, 2005). CODI is a public organisation under the Ministry of Social Development and Human Security. A neighbourhood savings group is one such mechanism. Each neighbourhood savings group is registered as a legal cooperative that is then granted low-interest rate loans from Baan Mankong.

Neighbourhood savings group members are charged a five per cent interest rate on the loans they take out. Two per cent is paid back to Baan Mankong; one per cent is used for savings in case people default on their loans; one per cent is used to pay the savings club secretary and one percent is used towards social welfare assistance such as funeral costs, school fees and community events. The savings groups build trust within neighbourhoods and the financial capital needed to secure loans. In Bang Bua, monthly land rental rates range from 40-60 Baht (GBP 0.74-1.11) per individual plot of land, depending on the size of the plot (RK27 an elderly woman; SM9, an elderly man; BB4, a middle-aged man; BB1, an elderly man). Home reconstruction loans are granted to the cooperatives for a maximum of up to 15,000 Baht (GBP 288), with a ten per cent down payment provided to the savings club.

Failure to repay the loan over a protracted period has resulted in the neighbourhood cooperative taking defaulting individuals to court. As a way of managing the overall upgrading of the plots, each participating neighbourhood cooperative elected a leader and a committee to guide its activities.

5.3.2 Neighbourhood governance structures

Neighbourhood governance structures follow a democratic election model. In each neighbourhood a leader and a committee are elected to guide the upgrading process, accountable to the members of the savings group. In some neighbourhoods, the leader and committee are the same as the government-elected leader and committee (accountable to the district authority), and sometimes they are different. CODI community development workers also shape the process by assisting neighbourhoods to develop partnerships with the local government, built environment professionals, universities, aid agencies and other Baan Mankong networks within the 277 cities where the programme is operating (Wungpatcharapon and Tovivich, 2012b). Usavagovitwong *et al.* (2013) write that in Thailand low-income settlements are organised into 'communities', and that when recognised by their local district office, the communities are required to hold elections, according to 1991 regulations.

Participants in Baan Mankong decide the criteria for participation. Below a CODI employee explains how the criterion for participation was established: 'We [CODI] had a meeting with the communities to set a definition of low income in Thailand so together we could determine the kind of communities that could join. Part of that definition includes a lack of security in house or land in dense communities. Household income is not more than 30 Baht per day. Neither CODI nor the government set this definition. In my opinion, a whole community is never entirely under this standard because they are mixed. But we accept a community when the majority faces these problems' (KI7, 2014).

The programme moved ahead incrementally in each neighbourhood in the Bang Bua Canal, working with the support base it had because not everyone wanted to join it at the start. After witnessing the progress, oftentimes more people joined in, adding another phase to the planning and construction work (KI30 professor; KI31 academic, BB4, a middle-aged

man). In a meeting with the central government, one leader said enthusiasm and momentum occurred because, 'respected people in the community started to mobilize people from all over the canal like a spider web' (BBFGD1, 2014).

Legal status of the land

With the support of CODI and the upgrading process described above, Bang Bua was the first canal in Bangkok to successfully negotiate a lease on the land with the National Treasury Department (Wungpatcharapon and Tovivich, 2012b). An memorandum of understanding (MOU) between the government and the canal network was signed formalising an agreement that each of the 12 neighbourhoods would form a cooperative and rent the land from the National Treasury Department on a 30-year renewable lease for a period of up to 90 years (BB4, a middle-aged man; BB2, a middle-aged woman; SM9, an elderly man; RK27 an elderly woman).

The negotiation resulted in a land rental agreement of one Baht per square meter, per month with adjustment for inflation every five years (Wungpatcharapon and Tovivich, 2012b). Two out of three of the case studies in this research, Bang Bua Neighbourhood and Saphan Mai, are renting the land. The third neighbourhood, Roi Krong, does not have enough people in its savings group to be able to pay the land rental cost. The primary reason Roi Krong is not renting the land is due to conflict over land sharing. People who 'own' larger properties or houses do not want to lose any portion of their assets because it results in direct loss of income. Further discussion of this point will take place in the case study on Roi Krong Neighbourhood in Chapter Nine.

5.3.3. Social dynamics and aspirations

While all 12 neighbourhoods were given the same upgrading opportunities, some demonstrated the ability to work together in the interest of community welfare more than others. Diverse needs, backgrounds, opinions, skills, income levels and opportunity has proven to be a strength and a challenge for canal dwellers as summarised in the following statement by a senior director of a local NGO that works in the area: 'The challenge is you have a mixed group of people. People who live on the land part of the neighbourhood have been there for a long time, maybe even 50 years ago now. The people who encroach on the canal and live on the canal are very poor. So you have a mix of not so poor and the very poor. You have rental rooms because Bang Bua is a central location. You have a lot of subdivided rooms. The room renters come and go so they don't have a lot of attachment to the community. They just want their room and to leave again in the morning' (K113, 2014).

Many social activities have taken place to build trust, relationships and understanding amongst neighbours. As mentioned earlier, drug trafficking used to be widespread within the canal, but there has been a social impetus to eliminate the trade. Local initiatives such as the placement of lights in dark public areas, the hosting of drug prevention activities for children, and the formation of volunteer police teams (RK27, an elderly woman) have had varying degrees of success in trust building, depending who was asked. However, most participants agree that the canal is safer today than it was ten years ago. A march against drugs is organised on a yearly basis between the nearby military base and the Bang Bua Canal network. Different communities are represented by small signs with their names on them. Many of the groups have chosen to wear a specific colour to represent their neighbourhood. Food and drinks are provided by the military; children from the communities offer entertainment by playing football matches; and the local government provides health care workers to do tests on blood pressure and other basic health check ups. As seen in

Figures 5.3.3a and 5.3.3b below, the military, government staff and neighbourhoods from around the canal march together through one another's neighbourhood as a sign of solidarity against drugs.



Figure 5.3.3a: Government and military personnel giving anti-drug speeches to the canal residents. Source: the author



Figure 5.3.3b: Military, government staff and canal residents from different neighbourhoods (adults and children) march in solidarity against drugs through different neighbourhoods. Source: the author

Aspirations

Leaders from the Bang Bua Network hold high economic and social aspirations for the future. Firstly, the Bang Bua Network wanted to develop a floating market for tourists, and believe they can do so with technical support from a nearby university (BBFGD1). However, before such a large undertaking can begin, one middle-aged woman in the network said they first needed to, 'improve all the houses and the quality of the water to make this a prettier place' (BBFGD1). Secondly, there was a desire to develop a safe and pollution free environment. One leader in the network said he desired an environment that was free from drugs and pollution (BBFGD1).

Thirdly, the need for further social bonding was mentioned by another leader who said it was important to have 'people connecting to each other and participating in the community' (BBFGD1). A continuation of the savings group was mentioned as important example of this. Many of the

network leaders explained that belonging to the savings group required 'discipline' from its members. Fourthly, it was expressed that the lack of youth leadership was a current gap. One leader said, 'the next generation needs to take on these responsibilities because there are no kids are helping out right now' (BBFGD1). One of the many reasons listed for bringing youth into the leadership fold is the potential for using technology to mobilise people. As one neighbourhood leader observed, 'we don't use computers, but our kids do' (BBFGD1).

5.4 Buildings and services

This section seeks to explain the ways in which economic, governance and social CAS have shaped buildings and services.

5.4.1 Building typologies

Over 90 per cent of the individual buildings along the canal are residential. This section will first discuss the residential buildings and the community centres, followed by public facilities.

Residential buildings

The majority of the upgraded residential homes are a mix of single unit housing and semi-detached housing made of concrete or wood or a mixture of both. Many are two to three stories. Between 5-10 per cent of the buildings are apartments constructed of concrete. Through direct observation, a building pattern has been identified throughout the canal whereby wooden buildings on stilts are erected over the canal, while homes on the landside are often made with a concrete foundation. Exceptions to this pattern can be found with a few homes on the landside having dirt floors. Wooden homes are vulnerable to fire because of the wood used to construct them, while single storey units on the canal are more vulnerable to flooding because of their location over the canal. Figure 5.4.1a below illustrates the range of residential building typologies

that can be found in the canal ranging from apartments to double storey terraced houses, single and double storey wooden houses on stilts, dormitories and single storey cement homes.



Apartments



Double storey terraced house



Single storey wooden stilt homes



Double storey wooden stilt homes



Dormitories



Single storey cement homes

Figure 5.4.1a: A mix of single unit housing and semi-detached housing made of concrete or wood or a mixture of both. A number of building typologies that can be found in the canal range from apartments to double storey terraced houses, single and double storey wooden houses on stilts, dormitories and single storey cement homes. Source: the author

Community centres

All three neighbourhoods have a community centre built with funding from the district government, aid agencies or private donations. Roi Krong neighbourhood also has a health centre. The community centres and health clinics were developed in the late 1990s to the early 2000s (RK27, and elderly woman, SM9 an elderly man). There are two types of community centres. The first is built of cement. The second is an outdoor gazebo structure, often seen in hotter climates. The community centres are pictured below in Figure 5.4.1b.



Bang Bua community centre (case 1)



Saphan Mai Community Centre (case 2)



Roi Krong Community Centre A (case 3)



Roi Krong Community Centre B (case 3)

Figure 5.4.1b: There are two types of community centres. The first is built of cement as shown in the top left and right photo and bottom left photo. The second is an outdoor gazebo structure, often seen in hotter climates as shown in the bottom right photo. Source: the author

Public facilities

Public facilities such as health clinics are dispersed throughout the canal, and are mostly made of concrete. Roi Krong has a health clinic. Saphan Mai's office doubles up as a health clinic. Bang Bua Neighbourhood does not have one but can access one several hundred meters away. Pictures of the health clinic are featured below in Figure 5.4.1c.



Figure 5.4.1c: A health centre a few hundred metres from Bang Bua Neighbourhood. The clinic is a single storey building made of cement. Source: the author

Bang Bua Neighbourhood has a library for children. It is a pilot project funded by the Bang Khen district government. The salary for one staff member is provided. Children from Bang Bua Neighbourhood and only one of its next door neighbourhoods have access to a new, but modest range of books and as well as a TV. Figure 5.4.1d shows the library's exterior and interior.



Bang Bua library – exterior view Bang Bua library – interior view (case 1)
(case 1)

Figure 5.4.1d: A library shared between two neighbourhoods. The building is constructed of cement. The exterior of the building is shown on the left and the interior on the right. Source: the author

5.4.2 Renters

While the upgrading scheme provided a unique opportunity for people to become homeowners, it seems to have marginalised renters. When the upgrading first occurred, neighbourhoods agreed that people who had not been renting in the area for more than five years would not be offered the opportunity to build a home. Furthermore, those who joined Baan Mankong were not allowed to rent their homes or parts of their homes. While Bang Bua Neighbourhood and Saphan Mai residents agreed to this criteria, a majority of residents in Roi Krong (approximately 60 per cent) did not agree to abolish renting, and thus refused to take part in the upgrading (RK13, an elderly woman; RK14, an elderly woman; RK17, a middle-aged woman; RK29, an elderly man).

5.4.3 Planning regulations and access to services

Policies towards the urban poor have changed throughout the years. From the 1940s to the 1990s there was a general reluctance to using community driven approaches to improving low-income settlements and housing (Usavagovitwong et al., 2013). In 1960 the Slum Clearance Act was passed by the Thai government; after then the First City Plan for Bangkok

determined that '740,000 (46 per cent) of the 1.6 million people in the city lived in areas described as deteriorated housing (*laeng suam som*) that needed to be rebuilt' (Johnson, 2009, p.30). In 1972 the National Housing Association (NHA) formed and in 1975 the Bangkok Metropolitan Authority's Division of Social Welfare, Bureau of Social Benefits took over responsibility for the provision of housing for poorer urban people (Usavagovitwong et al., 2013). In 1980 'enabling strategies' for low-cost housing for poorer urban people began to appear through private sector construction (Archer, 2009). However, the 1997 economic crisis led to government policies of self-sufficiency and decentralisation, and by the early 2000s community based organisations began to appear (Boonyabantha, 2005; Archer, 2009). Usavagovitwong *et al.* (2013) write that in 1980, 15 per cent of households in Bangkok could afford the cheapest housing provided by the private sector. By 1994 the number had increased to between 70 to 80 per cent (Usavagovitwong et al., 2013).

The density of low-income settlements is determined by Thai authorities based on the number of housing units per area, rather than by population density. For the BMA a low-income settlement equates to 15 houses per *rai* (One *rai* is equivalent to 1,600 square meters) or 47,000 people per square kilometer; for the NHA it is 30 houses per *rai* (or 94,000 people per square kilometer calculated based on the assumption of five people per dwelling). Both include a description of dilapidated buildings and harmful health conditions in their criteria (Usavagovitwong et al., 2013).

In a study on housing density and preference in Bangkok's low-income settlements undertaken by the International Institute for Environment and Development (IIED) (2013), it was noted that projects under the Baan Mankong programme 'failed to comply with the spatial requirements of the Building Control Act of 1979 and of the Comprehensive Plan Act 1992' due to 'financial constraints of the urban poor and the high cost of land' (Usavagovitwong et al., 2013, p.5). The Ministry of Interior accepted a

proposal by the NHA and CODI to relax the laws, resulting in a reduction of the minimum distance between houses, waiving of regulations for on-site sanitation systems and the overriding of the Comprehensive Plans' land-use controls (Bangkok's masterplan) (Usavagovitwong et al., 2013).

Access to services in the Bang Bua Canal

Usavagovitwong *et al.* (2013) write that access to services such as utilities, public schools and voting rights are only provided to houses legally registered with a local government district. However, that has not always been the case. Some neighbourhoods, such as Saphan Mai, have had electricity since 1974, regardless of their informal status at that time. According to one leader in the canal (KI34, an elderly man), politicians traded the offer of services in return for votes. According to neighbourhood leaders, when the Baan Mankong upgrading began, district governments shifted their policy and provided water for domestic use and electricity to registered houses only (KI34, an elderly man; KI36, an elderly woman). Drinking water continues to be purchased from stores or a distribution machine, which is located at the centre of many neighbourhoods. Wealthier houses own their own washing machines, refrigerators and air conditioners. The district government in all three case studies collects rubbish once a week. Housing participants in the upgrading received an 800-1,000 liter sewerage treatment tank. Those who did partial home reconstruction or did not participate at all continue to dump sewerage directly into the canal (RK27, an elderly woman; BB2, a middle-aged woman). Today, all registered houses along the canal have access to services such as electricity and water.

5.4.4 Social dynamics expressed through building usage

In 1981 the government changed its use of the word 'slum' to 'densified communities' (*chumchon ae at* in Thai) to neutralise negative connotations and to emphasise 'the physical conditions of the housing and its consequences for human life' (Johnson, 2009, p.31). The most recent

statistics for the total number of people living in low-income settlements or densified communities in Bangkok come from the NHA's 2001 statistics, which counted 1,604 'poor and informal communities' comprising 283,566 households (Usavagovitwong et al., 2013; Archer, 2009). One middle-aged woman from Bang Bua neighbourhood also described the neighbourhood as a 'slum' before a decade of home and neighbourhood upgrading occurred. She said: 'a slum is something you just know. You can tell by the way people look, how they speak, the quality of their houses and the fact that they fight with each other a lot. Before the upgrading, people called Bang Bua a slum. They didn't socialise with us and looked down on us. So we improved our houses, our education and the whole way we lived so people wouldn't look down on us' (BB2, 2014).

Where possible, the houses in the canal are designed with outdoor space to socialise in. More about the nature of social space and patterns and trends regarding the houses is discussed in subsequent chapters comparing neighbourhood case studies. The ways in which the community buildings are used and who uses them also explains a great deal about the social dynamics in each neighbourhood, which is also shared in subsequent case study chapters.

Conclusion

In conclusion, this chapter aimed to conduct an analysis of the historical transformation of everyday risks in the Bang Bua Canal through investigation of the ways in which economic, governance and social CAS influence four different morphological layers.

Analysis of the topography layer suggested that natural, political and social pre-conditions were set for a flood to have a great impact. As stated earlier, Bangkok is located in an area with a pre-disposition to seasonal flooding, which was an advantage to the area when it was predominately

an agricultural based society, but is a risk now that the area has urbanised. Institutional shortcomings in water and disaster management seem to have set up a political backdrop of a lack of preparedness, coordination, integration, research and budget for adequately managing water and disaster risk within the government. Moreover, most people in the Bang Bua Canal did not have a living memory of a flood before 2011, and therefore did not perceive flooding as a genuine risk.

The movement networks and public open spaces layer reveals that migrant workers without specialised skillsets settled in the Bang Bua Canal in search of jobs directly or indirectly linked to the arrival of Bangkok's first airport, and settled as renters or home owners in the area. This layer also concludes that historically, political battles transformed mobility networks around Bangkok through the need to protect the city from security threats and the desire to control trade. Finally, the layer explains how public open spaces host a range of diverse and changing economic activities within the neighbourhoods, depending on the time of day or night. It also explains that public open spaces and pedestrian lanes are used as spaces for information sharing, communication and social connectedness.

Analysis of the plots layer suggests that many plots dramatically transformed through Baan Mankong's upgrading programme, which attempted to introduce positive change in economic, governance and social structures that influence neighbourhoods. Through Baan Mankong, neighbourhoods in the Bang Bua Canal were given the opportunity to rent land owned by the National Treasury Department for a period of up to 90 years with individual plots paying GBP 0.74-1.11 per month. The savings groups within each neighbourhood played a crucial role in building trust between members in order to save and qualify for a cooperative loan from CODI. Baan Mankong also introduced new governance structures with a leader and a leadership committee to manage the upgrading in each neighbourhood. Furthermore, it assisted neighbourhoods to establish links

with external stakeholders such as universities, district governments and other groups in the Baan Mankong upgrading network. Finally, analysis of the plots layer revealed that individuals and neighbourhoods aspired to further transform their plots and communities by hosting a floating market, reducing pollution and stopping drug-trafficking as well as creating further bonding exercises to include youth in the hopes that younger generations will continue with upgrading activities in the future.

Lastly, analysis of the building and services layer suggests that based upon the range of building typologies in the canal there is a great diversity in socio-economic status within the canal, which creates different view points on upgrading. In Roi Krong Neighbourhood where the number of renters is high there are more people against the upgrading programme than for it. In Bang Bua and Saphan Mai Neighbourhoods, where renters are lower in number, canal dwellers felt more comfortable with the home ownership programme. Moreover, this layer identified that the municipal government adapted its planning regulations to accommodate the unique context of the canal by permitting houses to be built more closely together than is usual. It also found that access to services such as piped water and electricity had occurred in the canal in some places up to as early as 30 years before the upgrading programme began; however, access was reported to have improved with the upgrading programme.

Each of the morphological layers provides evidence that suggests modernisation and rapid economic growth has led to the proliferation of unplanned settlements and the growth of the informal economy in the Bang Bua Canal, impacting the types of daily risks canal dwellers face due to inadequate infrastructure, low-incomes, illegal tenure and low-quality housing. Failure to address everyday risks further complicates disaster risk with underlying unaddressed vulnerability. The next chapter will focus on disaster risk and the impact of the 2011 flood on the Bang Bua Canal.

Chapter six

A systems and morphological analysis of the 2011 flood in Bangkok and the Bang Bua Canal

Introduction

This chapter interrogates the 2011 flood, asking: what preparedness, response and recovery actions were prioritised in Bangkok and the Bang Bua Canal before, during and after the flood? The analysis explains how systems of economic flows, governance networks and social dynamics influence different morphological layers in order to identify drivers that affect disaster resilience.

Firstly, the topography layer presents a history of the 2011 flood, explaining the ways in which poorer people struggled to survive a lengthy period of unemployment; how national flood disaster management systems performed at a sub-standard level; and how after the flood there was a great emphasis on the social re-framing of disaster and development priorities. Secondly, the movement networks and public open spaces layer explains the impact of the floods on transportation and

mobility patterns, emphasising the importance of free and accessible public transportation and the way in which the canal (and Bangkok more broadly) was prepared to deal with impassible roads and flooded public open spaces.

Thirdly, the plots layer provides an analysis of the ways in which land rental agreements and other such financial mechanisms in the canal diversified coping mechanisms for dealing with economic pressures resulting from the flood. The plots layer also explains the importance of the Bang Bua Canal Network as a way of self-organising help that is targeted to specific needs. Fourthly, the last morphological layer – building and services – explains how poorer people were disproportionately affected because of the low-quality buildings they inhabit, and the ways in which district authorities were limited in their capacity to help neighbourhoods in the Bang Bua Canal.

The methodological approach for this chapter includes a review of secondary documents such as assessments and evaluation reports of the 2011 flood from a range of agencies including the World Bank, the Association of South East Asian Nations (ASEAN), Save the Children, Asian Disaster Preparedness Centre (ADPC) and others, which are referred to later in this chapter. Additionally, 40 key informant interviews were conducted with neighbourhood leaders; international and national aid agencies; officials from the district, municipal and national government; academics and think tanks. Focus group discussions were also conducted, including six FGDs with canal dwellers; one with five people from the World Bank and one with four people from CODI, a local NGO. Multiple maps from Bangkok's master plan were analysed for physical data. Each neighbourhood's unique history and composition is interrogated in the following chapters, Six, Seven and Eight.

6.1 Topography

Analysis of the topography layer provides a summary of how the 2011 flood occurred and the extent of its impact. The layer then focuses on Thailand's national flood response explaining how the country was largely underprepared, and the way in which it is adapting its national disaster management systems and policies. The ways in which Thailand is re-framing its disaster and development priorities as a result of the 2011 flood is then presented. The topography layer closes with an explanation of the economic impact of the flood on poorer people in the canal and in Bangkok more broadly.

6.1.1 Summary of the 2011 flood

The worst flooding Thailand had seen since 1996, started in late July 2011 (Aon Benfield, 2012). An uncommon number and strength of five consecutive tropical storms deposited unusually large amounts of rainfall from July to October 2011. Subsequent dam breaches and a high tide in the Gulf of Thailand (Olarn, 2011; World Bank, 2012b) contributed to widespread flooding that affected 65 out of 77 provinces (Aon Benfield, 2012).

By January 2012, more than 800 people had been killed (Phongnongsung and Borchard, 2012; Aon Benfield, 2012), six million hectares of land inundated with flood water and 13 million people affected (World Bank, 2012b). The World Bank (2012b) estimated the cost of rehabilitation and reconstruction at THB 1.5 trillion (GBP 2.7 billion), with the manufacturing industry accounting for 80 per cent of the total.

The damage inflicted by the 2011 flood has been attributed to a combination between nature, poor governance and weak land-use planning (Pongsudhirak, 2011; Haraguchi and Upmanu, 2014; UNESCAP, 2014; Boonyabantha and Archer, 2011). Figure 6.1 below shows images of national flooding from August until November 2011 underscoring the

extreme nature of the flood, not only in Bangkok but nation-wide. The full spatial peak of the floodwater has been marked on the map in gray by UNITAR/UNOSAT overlaid with colour in order to provide a month-by-month comparison of the coverage.

The first map indicates floodwater in yellow during mid-August 2011. The second map depicts floodwater with the colour orange in mid-September, showing the water travelling further south. The third map shows that floodwater had reached Bangkok by mid-October (depicted in red) and had become more widespread in an east to west direction.

The fourth map illustrates the floodwater mid-November in purple showing floodwaters receding in the north and to some extent in the south near Bangkok. When UNITAR/UNOSAT published the graphics, it warned that floodwaters had likely been 'systematically underestimated along highly vegetated areas along main river banks, and within built-up areas within Bangkok' due to limitations of the satellite data used (UNITAR/UNOSAT, 2011, np).

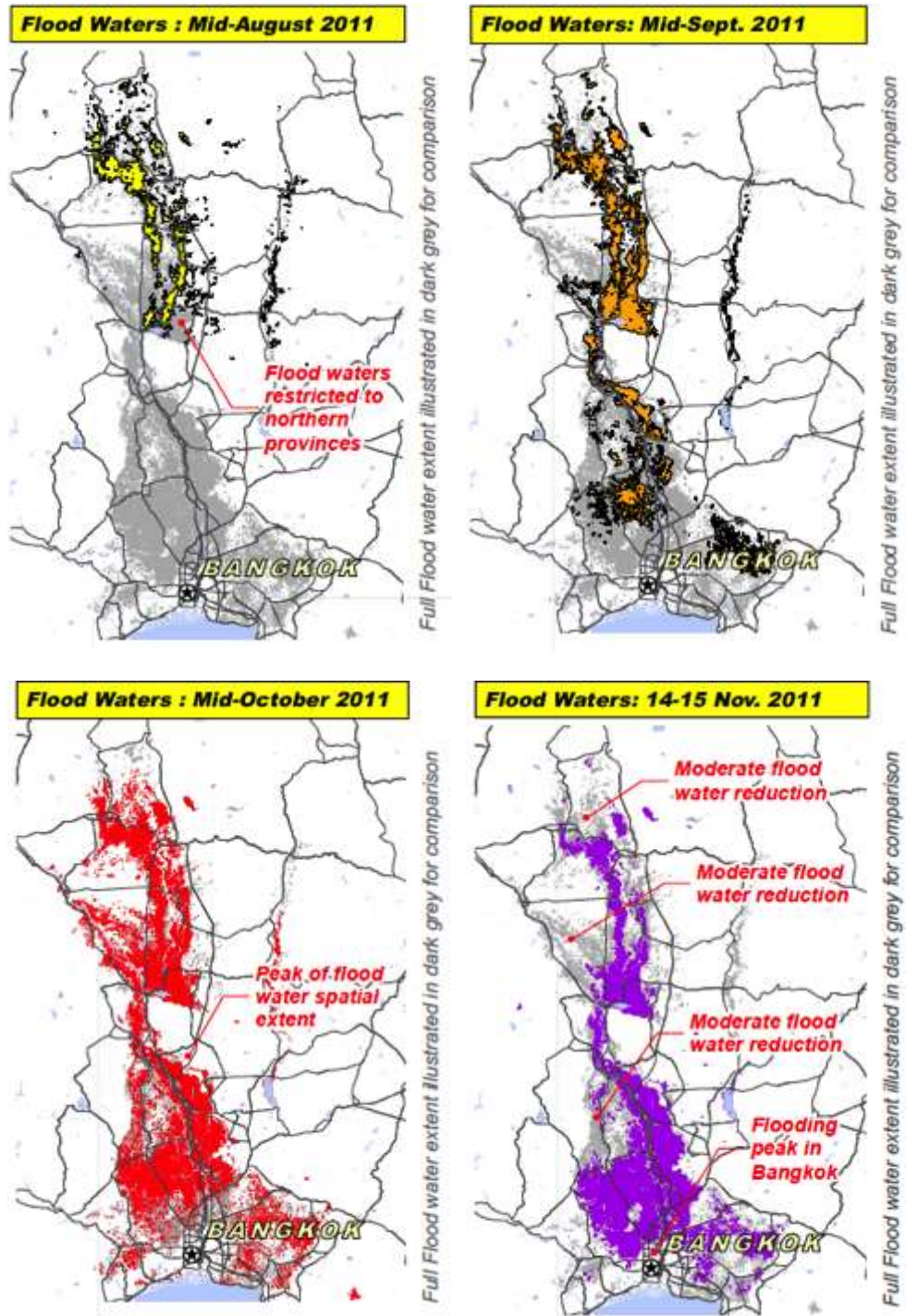


Figure 6.1.1a: The four graphics above illustrate the flood water moving from northern Thailand down to the Gulf of Siam through Bangkok. The first map illustrates floodwater (marked in yellow) in mid-August. The second map shows floodwater (marked in orange) in mid-September. The third map indicates floodwater (marked in red) in mid October. The fourth image depicts floodwater (marked in purple) in mid-November. The full spatial peak of the floodwater is marked in gray in all of the maps as a source of comparison. Source: (UNITAR/UNOSAT, 2011).

Having explained how the flood occurred and its extensive impact, this chapter will now examine the ways in which the flood response was handled at a national level and the way it impacted Bangkok and the Bang Bua Canal.

6.1.2 National flood management

Thailand, and more specifically Bangkok, was largely unprepared for the 2011 flood, for several reasons related to governance. In July 2011, nearly one month before the flood started, a change in national government occurred bringing with it new staff to new posts. Government coordination was cited as one of the biggest challenges in the 2011 flood with preparedness and response frameworks believing to have achieved little of what they were designed to do (Barber, 2012), despite having a national Department of Disaster Prevention and Mitigation (DDPM) (established in 2002) and as stated earlier, a Disaster Prevention and Mitigation Act that was passed in 2007 (UNESCAP, 2014; ADPC, 2013b) dedicated to shaping disaster management.

Pongsudhirak (2011), a journalist from the UK newspaper The Guardian, pointed to government ministers for issuing different and conflicting messages that resulted in inter-agency conflicts within the government and a lack of policy coordination. Water analysts note that the 24 dams operating in Bangkok's Chao Phraya River should have released water earlier than they did to compensate for the heavy monsoons (IRIN, 2012; Koontanakulvong, 2012). A lack of coordination and inaction between various central and local government agencies is believed to have resulted in the overflow of several dams (Pongsudhirak, 2011).

Experts on low-income housing, Somsook Boonyabanha and Diane Archer (2011), posted in a blog for the UK International Institute for Environment and Development (IIED) that water management in Thailand is a 'sensitive

political matter' and cited weak coordination between 16 organisations from four ministries as a key factor for increasing the severe impact of the flood (2011). Boonyabancha and Archer (2011) believe that effective collaboration in Bangkok was especially hindered due to the tenuous relationship between the governing Democratic opposition party and the Pheu Thai central government, giving rise to what they described as 'political games'.

One key informant from a local NGO interviewed for this research said the impact of the flood was greater because of the political divide in the following statement: 'The central government gives money to a certain ministry or agency, and in many cases they go directly to the affected community to distribute goods. Thailand is like that. The local authority is always being bypassed by the central government. Sometimes there is collaboration and the central government department links with the local authority. But when the politics are tight, the central government tends to bypass to link with the community directly in order not to give credit to the local authority because the local government is from one party and the central government is another' (KI3, 2014, a senior NGO leader).

Powerful politicians and other influential actors were accused of protecting their constituencies at the cost of redirecting floodwater into other areas. At times their actions resulted in protests that led to the dismantling of flood protection barriers (Pongsudhirak, 2011; KI2, 2014, a national government informant; KI4, 2014, a BMA informant; KI9, 2014, journalist). Humanitarian news and analysis agency, Integrated Regional Information Networks (IRIN), writes that complicated water management structures allowed powerful governors to redirect flood waters to poorer areas, and recommended a single command management authority take over to avoid abuse of power (IRIN, 2012).

The 2011 flood has been described as a re-enactment of the urban-rural divide, (whereby the previous national government was popular with the rural poor, but strongly disliked by the urban middle-class and elite) as demonstrated by floodwaters submerging poorer provinces along the Chao Phraya river basin in order to save the more affluent city of Bangkok (Boonyabanha and Archer, 2011). Flood prevention in Bangkok was prioritised by the national government, although some surmise that if flood waters had been permitted to exit through Bangkok where water historically and naturally exits, the flood would have dissipated more quickly (Pongsudhirak, 2011; KI2, national government informant; KI6, municipal informant). Pongsudhirak contends that a quick exit through Bangkok would have also alleviated political woes between rural and urban groups, writing that: 'if Bangkok shares some of the flooding, economic damage will mount but a sense of equality and justice will prevail (Pongsudhirak, 2011, np).

A humanitarian response review by the NGO Save the Children and the Agreement for Disaster Management and Emergency Response (AADMER) Partnership Group (APG), a group within the Association of South East Asian Nations (ASEAN), found that while the Thai government set up a centralised Flood Relief Operations Center (FROC) to support affected provinces and allocate financial assistance for relief and recovery operations, it was headed by the Ministry of Justice and operated by staff whose expertise did not match the task (Barber, 2012). The report also states that at the national level, response capacity was low and preparedness planning was under-utilised (Barber, 2012).

After the flood, steps were taken to address policy related disaster management gaps. Four key national plans summarised below directly address gaps such as water management, coordination and the development of standard operating procedures (SOPs). The national plans

focus on strengthening institutional capacity; addressing challenges related to climate change and natural hazards; issues around water resource management and coordination by instating a single command structure; and integrating disaster prevention, mitigation, preparedness and emergency management within relevant sectors of the national government.

An assessment report on disaster management planning, policies and responses in Thailand by the Asian Disaster Preparedness Centre (ADPC), the NGO HelpAge International and APG suggests disaster management policy is being taken more seriously at a national level with the development of new national plans since, post 2011 floods (ADPC, 2013a). The four key national plans that were developed post-2011 floods are (ADPC, 2013a):

- I. The Eleventh National Economic and Social Development Plan, (2012-2016) aims to develop people and strengthen institutions and build a secure natural resource and environmental base, which requires reducing vulnerability to climate change and natural hazards in order to meet a vision of 'A happy society with equity, fairness and resilience' (ADPC, 2013b, p.2).
- II. The Master Plan on Water Resource Management (2012) outlines short and long-term actions for effective water management, integrates participation of all water management stakeholders and provides a framework for Single Command Water Management for planning and effective response, developed by the Strategic Committee on Water Resource Management (SCWRM).

- III. National Disaster Prevention and Mitigation Plan (2010-2014) outlines principles and procedures for disaster management of natural hazards and security threats (ASEAN Inter-Parliamentary Assembly, 2012). There is a focus on prevention, preparedness, emergency management and post-disaster management at all levels and within all relevant sectors.
- IV. Strategic National Action Plan (SNAP) on Disaster Risk Reduction (2010-2019) mainstreams disaster risk reduction into governmental agency planning and response. It is a national framework and strategic plan that aligns with the Hyogo Framework for Action (HFA), AADMER's strategic plan and Thailand's DDPM.

While the presence of the national plans suggests progress, this alone cannot be a measurement of success. Assessment of their effectiveness is required to better understand the implications of each of these four plans.

This section on national disaster management explained key gaps in the flood response by the national government and its partners such as local authorities and a range of government agencies. It then discussed the ways in which the government is working with its partners to address policy gaps within disaster management. The next section will explain the ways in which Thailand is seeking to re-frame its disaster management and development priorities from a social vulnerability perspective.

6.1.3 The social re-framing of disaster and development priorities

The reconstruction phase of the flood was an opportunity for the government to re-frame and re-prioritise economic and political development policies in a way that addresses social vulnerability. In October 2011, a rapid assessment of the impact of the flood was conducted in 26 provinces across 18 sectors, led by the Ministry of Finance

in cooperation with the World Bank and other development partners. Post-disaster recovery and reconstruction needs were established for short, medium and long-term periods in a report titled *Thai Flood 2011: Rapid Assessment for Resilient Recovery and Reconstruction Planning* (World Bank, 2012b). The rapid assessment report recommended that the Thai Government take care to ensure a 'comprehensive social accountability framework' be put in place at a cost of THB 1 billion (GBP 5.1 million), highlighting the importance of accountability and transparency in light of recent political tensions (2012b, p.7). The World Bank (2012b) further recommended that such a framework ensures timely access to information on recovery programmes is available to the general public, including the resources and levels of assistance being offered; that a complaints mechanism be established; a rigorous validation processes for cash transfers and participants for public work schemes is put in place; and that partnerships are established with civil society, research institutes and the media to monitor the recovery process.

Furthermore, the World Bank's Rapid Assessment Report (2012b) recommended balancing investment in physical infrastructure to adapt to and mitigate against future climate risks in conjunction with activities that build the capacity of civil society. The report also recommended that social systems be supported and grown through activities such as publicly accessible mapping and modeling of geographically distributed risk; public trainings with risk maps to increase flood preparedness in neighbourhoods; establishment of an effective early warning system based on accurate, timely data that takes into account geographic and infrastructure details from hazard mapping; and clear messaging regarding disaster management that can be trusted by the public (World Bank, 2012b).

At the time of writing (2015) the military was in power and re-writing the constitution. No documentation was found regarding how many of the recommendations from the World Bank's Rapid Assessment were taken forward, nor were any key interviewees able to offer any insights. Having outlined some of Thailand's key social vulnerabilities and the potential ways in which the Thai Government can act to assert a new comprehensive social accountability framework, this layer will now explain the economic impact of the flood on poorer people.

6.1.4 Economic impact on poorer people

The World Bank (2012b) estimates that 129 THB billion (GBP 2.3 billion) in wages were lost due to the floods, including from poorer and marginalized households with limited social protection. Suspended livelihoods activities and challenges finding short-term, temporary, alternative forms of work resulted in the loss of income for poorer urban people. Daily wage earners were one of the worst affected groups (Phongnongsung and Borchard, 2012; UNESCAP, 2014); their primary coping strategy involved heavy reliance upon borrowing money to meet basic needs (World Bank, 2012b). With a lack of access to formal lending and credit sources, poorer urban people turned primarily to informal lenders with daily interest rates as high as 20 per cent (World Bank, 2012b). A leader of one of the neighborhoods (KI34) echoed the World Bank's findings, stating that many people from the Bang Bua Canal borrowed money from friends and informal lenders, most of who charged daily interest rates of 20 per cent.

Acknowledging the importance of livelihood support after a disaster, the World Bank's Rapid Assessment Report recommended to the Thai government that more livelihoods programmes be offered with a strong emphasis on 'principles of equity, beneficiary and community participation, transparency and accountability', particularly for two vulnerable groups (including migrants): able-bodied labourers who could

participate in cash for work and a separate programme for people who could not provide labour such as the sick, the elderly, disabled persons and children (2012b, p. 12). Furthermore, the World Bank's Rapid Assessment Report (2012b) recommended social assistance to be provided by the government in the form of one off 'supplemental cash transfers' of THB 4,000 (GBP 74) per household and three months of supplementary income support for the elderly and disabled, which would see an increase from THB 500 (GBP 9) to THB 1000 (GBP 18). Their final recommendation was to increase access to credit institutions for poorer urban people through non-profit organisations and community/neighbourhood savings groups to prevent downward spirals into debt. It is not known if these recommendations were acted upon; however, almost every person interviewed from one of three Bang Bua neighbourhoods reported receiving cash from the government of 5,000 Baht (GBP 92) for flood damage to their houses, regardless of whether or not their houses were registered.

This topography layer has highlighted the impact the 2011 flood had on poorer people in Bangkok due to a poorly coordinated national and municipal flood response, and how as a result, the national government has made attempts to improve disaster response frameworks and policies. It has also highlighted recommendations for reframing disaster and development programmes from a social equality approach. The topography layer then highlighted the economic impact of the flood on poorer people. Subsequent case study chapters will provide specific details on manifestations of the social, economic and physical impacts of the flood. The next section will explain how the flood impacted the movement networks and public open spaces.

6.2 Movement networks and public open spaces

Overall, the flood damaged or destroyed portions of 1,700 roads, highways, and bridges across Thailand costing the Department of Highways and the Department of Rural Roads an estimated THB 139 billion (GBP 2.5 billion) in road repairs alone (Aon Benfield, 2012). Bangkok's secondary airport, Don Mueang, closed down from October 2011 until March 2013 due to flood water entering a terminal building and damage to a runway (Aon Benfield, 2012), reducing the number of flights going in and out of Thailand. Import and export businesses were impacted and supply chains were disrupted.

Leaders in the Bang Bua Canal prioritised mobility and transportation in their preparedness efforts. Before the flood struck, CODI provided a 75,000 Baht (GBP 1390) grant to the Bang Bua Canal Network to enable them to preposition food and other essential supplies. The Bang Bua Canal Network built 12 boats – one for every neighbourhood in the network as part of its preparedness measures (BB4, a middle-aged man; BB20, a middle-aged woman).

6.2.1 City-scale risk reduction, preparedness and mitigation and the impact on local neighbourhoods

Before the 2011 flood occurred, people within the Bang Bua Canal tried to remove rubbish from the canal in coordination with the local government in order to increase the canal's water carrying capacity and decrease the risk of flooding. One senior person working for a local aid agency said, 'The city didn't clean the canal. We cleaned the canal. We tried to dig up the canal because it became very shallow.... A lot of garbage was sinking and piling up in the middle of the canal. The people coordinated with the district to bring the garbage trucks. I cannot remember the number of trucks but it was a very dramatic number - 50 or something. They tried to show that the community is not the one who makes the flood happen.'

The community is not the one who makes the pollution. We are the ones who protect the canal' (KI3, 2014).

In spite of the risk reduction measures taken by residents of the Bang Bua Canal, flooding still occurred. The military tried to protect city infrastructure by creating walls out of sandbags. The erection of the walls determined which neighbourhoods flooded. The canals in Bangkok were some of the first locations in the city to flood (UNESCAP, 2014). When the flood became imminent, local leaders in the Bang Bua Canal used existing public speaker systems to warn the elderly, immobile, sick and young to evacuate immediately. The speaker systems were subsequently used to provide flood updates, except for in Roi Krong neighbourhood, where the speakers were not elevated and were inoperable due to water damage.

6.2.2 Free public transport and income generation

Military forces were instrumental in opening up access to free public transportation via heavy-duty equipment that could easily maneuver flooded roadways and highways (Figure 6.2.2a). The large transport equipment enabled the army to conduct search and rescue and distribute essential food and non-food items in areas severely affected by the flood, and inaccessible to other emergency responders. Access to public transportation was crucial in enabling poorer urban people to continue working. Some people from the Bang Bua Canal said they used free transportation to travel to a market 23 kilometres away to purchase fresh food for local resale on donated plastic boats (Figure 6.2.2b) or small, homemade rafts made from plastic and bamboo materials (SM24, a middle-aged woman; RK13, an elderly woman) pictured below in Figure 6.2.2c.



Figure 6.2.2a: Heavy-duty military trucks offered free public transportation to people from the Bang Bua Canal during the flood. Source: Pattawan Lamjiek



Figure 6.2.2b: An example of the small plastic boats donated to canal dwellers to increase their mobility. Source: Pattawan Lamjiek



Figure 6.2.2c: An example of the homemade rafts used by canal dwellers. Plastic barrels, styrofoam and bamboo were commonly used materials. Source: Pattawan Lamjiek

People who were unable to work or who begged for food before the flood, continued to do so during the flood. Key informant interviewees reported sharing food and water with needy people who travelled on rafts (SM26, a middle-aged woman). Compassion and the philanthropic spirit of Thai people was commented on by a senior monk who said, ‘we found one thing in the floods among Thai people: people helping each other and showing compassion. You could see cars driving around giving rides to people, even if the driver didn’t know who the person was. That was the generosity of people. Background didn’t matter then’ (SM33, 2014). Free public transport and makeshift devices such as rafts therefore were crucial to opening up economic access for financially vulnerable groups of people.

6.2.3 Public open spaces

Public open spaces are spaces that are accessible to all. During the flood most of the public open spaces flooded except for elevated areas such as bridges. Bridges were used to store motorcycles (Figure 6.2.3a). They were also the place where aid agencies distributed survival items and some local

politicians ran food kitchens. A public health system run by the district government was implemented in all the neighbourhoods in the canal whereby different coloured flags were used to identify various vulnerable groups in order for the district to provide appropriate assistance such as diapers for babies (BB20, an middle-aged woman; RK27 a middle-aged woman). The system was not taken up by other flood response stakeholders and due to the low capacity of the government to respond to the needs of survivors, the flag system appears to have made little difference in the response.



Figure 6.2.3a: An example of how people used public open space on elevated bridges to store their privately owned goods such as motorcycles. The open space on the bridge was also used by aid agencies to distribute goods and by local politicians to set up food kitchens. Source: Pattawan Lamjiek

Analysis of the public open spaces layer is minimal due to the limited use of public open spaces during the flood. Therefore, having explained the impact of the flood on movement networks and public open spaces, the analysis will shift to an explanation of the flood impact on the plots layer.

6.3 Plots

Analysis of the changes to the plot patterns in the canal before, during and after the flood provides insight into the ways in which economic, governance and social CAS interact to shape plots. During the flood individual plots were entirely submerged in water restricting socio-economic activities within individual plots and the larger plot of the entire neighbourhood. This layer of analysis will focus on how economic, governance and social systems adapted to the new challenges posed by the flood.

6.3.1 Financial pressures related to plots

While it can be argued that the plots received flood damage, most of the focus was on the damage to buildings. The financial systems developed within each neighbourhood plot (explained in the plots section of Chapter Five) were tested during the flood. Many of the canal dwellers were without work for several weeks and sometimes months, therefore it was difficult to pay mortgages and land rental costs associated with the upgrading. After negotiations with CODI and the Bang Bua Canal Network, the landowner (the National Treasury Department) took a decision to delay land rental payments for one year, allowing people more time to replenish their income (BB2 neighbourhood leadership, SM9 neighbourhood leadership). Some of the Baan Mankong savings groups made cheaper loans available to struggling households (KI34 neighbourhood leader, KI36 neighbourhood leader).

However, the details of such arrangements will be discussed in each of the case study chapters. Canal dwellers were also given cash grants from the government to repair their homes – illegal or not because status did not matter – but further discussion of this will take place in the buildings and services layer.

6.3.2 Flood management through the canal network

Before the flood struck Bangkok, neighbourhood leaders and other volunteers from the Bang Bua Canal travelled more than 230 kilometres to assist with the flood response in the northern Thai city of Nakhon Sawan. Bang Bua Canal dwellers put the experiential learning into practice less than a month later when their own neighbourhoods began to flood. Leaders said they felt experienced in flood preparation and response, including how to set up and run a network 'help centre' that managed donations for all neighbourhoods in the network.

When the flood reached the Bang Bua Canal, water remained for three months, reaching one meter high for nearly a month (SM9 neighbourhood leadership). The Bang Bua Canal network quickly set up its own help centre with assistance from CODI. The help centre received donations and coordinated distributions. It shared information updates, including data on neighbourhood needs and the trajectory of the flood. Individuals in the network came up with innovative ways to harness new potential from old relationships with various external stakeholders developed over the past ten years of upgrading. For example, local politicians donated food and money; universities sent students with specialised skills such as medical practitioners and engineers to advise on ways to prevent electrocution. Some neighbourhood leaders had wealthy friends who drove supplies into the neighbourhood from cities and towns outside of Bangkok.

Those employed by the military used their network to access information, food, and transportation. Most donations were dropped off at the help centre where items were sorted and redistributed according to differing needs within the various neighbourhoods. Smaller neighbourhood kitchens were also set up in spaces with minimal flooding such as bridge ways, public roads or community offices. Volunteers cooked and served food purchased from neighbourhood savings funds or local distributions.

At times the network rivaled the district in terms of effectiveness of its flood response as evidenced by the fact that during the crisis the Bang Bua Canal Network grew its membership from 17 to 38 neighbourhoods (KI33, a neighbourhood leader).

One man said the network aspired to run its own fully functional evacuation centre if future events like this occurred (KI32, a neighbourhood leader). However, not all neighbourhood leaders preferred working through the peer network. One leader who was not active in the Baan Mankong upgrading programme felt support should have been directly given to elected neighbourhood leaders in order to ensure it was distributed fairly. All leaders interviewed were very clear that aid should be given to the government as a last resort due to the fact that it reached the neighbourhoods too slowly.

6.3.3 Self organisation at the neighbourhood level

The ability to self organise was paramount to an effective flood response in the canal. Reflecting on the experience of setting up the help centre, one leader from the canal network explained that because relationships were tightly knit it was easier to set up the help centre (KI32). One leader explained that the ability to self organise is important during times of crisis, saying, 'our process is run by our community. We know best what we want, how to manage it and what we are facing' (KI33, 2014, neighbourhood leadership). He then said, 'the lesson we learned from the flood was the importance of being a part of the [Bang Bua Canal] Network instead of trying to survive as a neighbourhood on its own. This network offers power and support for negotiation. We get assistance to people who really need it. The network has been good for both the giver and the receiver' (KI33, 2014, neighbourhood leadership). Other members within neighbourhood leadership roles said that the network prevents conflict and avoids unfair and unequal treatment of individuals, and that

whenever a network is available, it is advisable to use it, not to distribute goods directly to individuals (KI34, a neighbourhood leader; KI36, a middle-aged woman).

Having discussed the economic, governance and social influences on the plots layer during the flood, the following section analyses the buildings and services layer.

6.4 Buildings and services

The buildings and services layer provides analysis of urban form at a small scale, giving insights into key economic, governance and social dimensions that helped build resilience. This layer specifically focuses on explaining how poorer urban people were disproportionately affected by the floods due to the low quality of the buildings they lived in. This section also explains how the government district authorities were limited in their capacity to respond to the needs related to shelter and services within many neighbourhoods.

6.4.1 Poor quality housing and vulnerability to flooding

Figures from the National Housing Authority (NHA) show that the flood disproportionately affected poorer urban people. Out of an estimated low-income population of 624,640 in Bangkok, the NHA estimates that 457,805 people (approximately 73 per cent of Bangkok's low-income population) were affected through data collected by GIS mapping and ground surveys before and after the flood (UNESCAP, 2014).

Table 6.4.1 below offers a comparison between the total population of Bangkok and the total population of urban poor.

Total population of Bangkok	Total population of urban poor in Bangkok
Population of Bangkok: 8,249,117	Total number of low-income population: 624,640
Total number of flood affected people: 1,766,931	Total number of low-income flood affected people: 457,805
Percentage of flood affected people: 21 per cent	Percentage of flood affected: 73%

Table 6.4.1: The total population affected by the flood in Bangkok compared with the total population of low-income people affected by the flood. Source: this table uses information drawn from (UNESCAP, 2014).

Many of the low-income homes are located in open spaces along canals and rivers, and are primarily single storey homes constructed with light timber or bamboo and corrugated iron, therefore making poorer urban people one of the most affected groups during the flood (UNESCAP, 2014). Flooding in the canals tended to linger the longest. Figure 6.4.1a below shows a map of flood-affected low-income neighbourhoods in Bangkok, depicted by red dots. Low-income neighbourhoods not affected by the flood are indicated in green. The map shows that the flood affected a lot of low-income neighbourhoods in northern Bangkok, including the Bang Bua Canal.

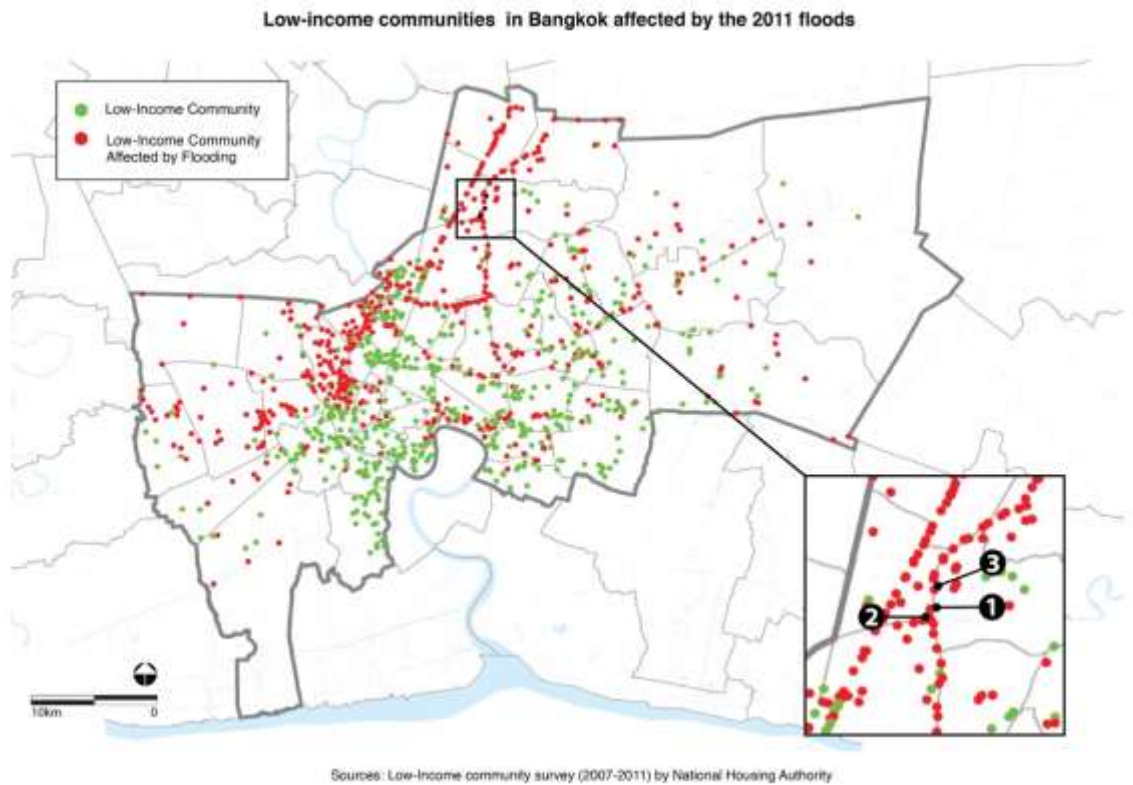


Figure 6.4.1a below shows a map of flood-affected low-income neighbourhoods in Bangkok, depicted by red dots. Low-income neighbourhoods not affected by the flood are indicated in green. Source: (National Housing Authority of Thailand, 2011).

In the Bang Bua Canal, the most vulnerable people were those who lived in one-storey homes; people who were unemployed; illegal migrant workers; or people who generally required more protection such as children, the elderly, or those with mobility challenges. People living in two-storey homes had a second floor to evacuate to, but those in one-storey homes were particularly vulnerable because there was nowhere to escape the floods. Moreover, homes constructed of low-quality materials such as wooden flooring and walls, rotted during the three months of flooding. Stilt houses built over the canal were reported by people to be sinking in the mud due to subsidence (RK20, a middle-aged man; RK13, an elderly woman). Moreover one-storey homes had limited places to store valuables such as beds, TVs and motorcycles out of the reach of floodwater. Figure 6.4.1b below is a photograph of a series of single storey homes surrounded by floodwater. Many of them are made of wood and corrugated iron, which quickly rusted when the floodwater receded.



Figure 6.4.1b: The Bang Bua Canal during the 2011. The most vulnerable houses in this photograph are single-storey homes made out of wood and corrugated iron. Single storey homes received a significant amount of damage to their floors, walls and valuable household items that could not be elevated out of the reach of the floodwater. Source: Pattawan Lamjiek

Figure 6.4.1 below shows the inside of one woman's single storey home. The walls are covered over in rusted corrugated iron. The home has limited space to store valuables. There are a few elevated planks of wood on the right hand side of the photo to store things. The canal has flooded and is waist height in the photograph. It remained at this level for over a month.



Figure 6.4.1c: One-storey homes left people vulnerable to flooding. Source: Pattawan Lamjiek

After the flood the central government gave a grant of 5,000 Baht (GBP 92) to each household as compensation for flood damage. Key informant interviews with canal dwellers and district authorities confirmed that homes did not require formal registration to receive the government grant; rather the existence of a home qualified the owner to receive the grant. Most people interviewed in the Bang Bua Canal received the grant but said it was not enough to cover the cost of the total flood damage to their homes.

Financial burdens were further lightened through a period of grace granted to residents with home reconstruction loans. Negotiations between the neighbourhoods and CODI over land repayment resulted in a one-year freeze on repayments (RK27, a middle-aged woman; SM9, an elderly man).

6.4.2 Evacuation centres and vulnerable people

The NGO Plan Thailand reports that at the peak of the flood, more than 2,600 evacuation shelters housed over 165,000 people in need of temporary accommodation (Phongnonsung and Borchard, 2012). Nearly 900 schools were turned into flood evacuation shelters (Phongnonsung and Borchard, 2012). Save the Children found that well meaning, well intentioned people who do not have disaster management experience were often in charge of evacuation centres (Barber, 2012). A number of residents from the Bang Bua Canal evacuated to the nearby temple Wat Pra Si where a group of 60 monks were providing food and accommodation to some 300 people. The monks described their key challenge during that time as 'taking care of people'. One senior monk went on to explain that although not permitted, youth were found drinking; minor vandalism occurred; and disputes between families over equitable distribution of relief items were frequent.

The flood damaged an estimated 2,934 schools and delayed the school term by more than 21 days, affecting over 1.4 million children (Phongnonsung and Borchard, 2012). To make up for lost time students studied for one extra hour during their daily schedule and for additional time on Saturdays. One school teacher explained that the school year was also extended into summer holidays to complete the full curriculum (SM26, a middle-aged woman).

A Save the Children assessment report of the flood response in Thailand noted that no formal provisions for migrant workers were made by the disaster management authorities who did not see the needs of migrant workers as their area of concern (Barber, 2012). Also, the stress of the flood took its toll on mental health. The Ministry of Public Health reported that psychosocial issues amongst flood-affected people included high levels of stress, depression and suicide risk (Watts, 2011).

Evacuation centres were often considered a last resort. Most people in Bang Bua neighbourhood and many in Saphan Mai neighbourhood did not have to evacuate because they were able to live in the second storey of their homes. They also had access to basic services such as water and electricity. According to the leader of Roi Krong, approximately 40 per cent of the people in the neighbourhood evacuated. One middle-aged woman interviewee who stayed in an evacuation shelter for the duration of the flood said her family went there because there was 'food', a 'place to sleep' and that 'life was better there' (KI32, 2014). Key informants said they employed a number of coping strategies in relation to food security, including reducing the amount and quality of food they ate, as well as moving between their homes and evacuation shelters to pick up donations at both locations (RK28, a middle-aged man; BB8, a middle-aged woman).

6.4.3 Government district authorities and local neighbourhood needs

The district authorities have primary responsibility for providing flood relief services, but were limited in their capacity to adequately respond to local needs. Government staff in Lak Si district cited a lack of knowledge, funds and coordination as some of their key challenges (KI37, a middle-aged man; KI15, a middle-aged woman). The Bang Bua Canal acts as a boundary line between the district of Bang Khen and Lak Si. Both districts governing the canal said they were inexperienced in preparation and response for large-scale flooding. The Lak Si district government stated that it was problematic for them to procure funding for food and non-food

items during the emergency as well as cleaning supplies and equipment after floodwaters receded (KI37, a Lak Si district government officer). According to Lak Si government key informants there was limited access to the federal emergency response system, which left the local government not knowing who to coordinate with and where to request supplies. The same district officer said, 'we are supposed to be the official authority, but in reality we are not' (KI37, 2014, a government officer from Lak Si District). The Bang Bua Canal Network is comprised of neighbourhoods from both Bang Khen and Lak Si districts, and therefore coordinated activities with both district offices.

Having explained the ways in which poorer urban people were disproportionately affected by the flood due to the types of buildings they lived in, this chapter ends with a summary of the issues raised and draws some key conclusions.

Conclusion

This chapter provided an analysis of how different morphological layers were impacted by the 2011 flood with a focus on the Bang Bua Canal and its link to systems within municipal Bangkok and Thailand more broadly. Analysis of the four morphological layers provides a framework for assessing the ways in which economic forces, governance networks and social dynamics interacted to shape events and activities before, during and after the flood.

The topography layer discussed key facts about the flood impact, suggesting that while the unusual number of tropical storms created the potential for the flood, governance factors related to a lack of preparedness and an inability to coordinate a flood response at multiple levels played a major role in the widespread impact. The national flood management response was then analysed, concluding that poor

coordination was a result of ineffective preparedness frameworks at a national level, conflict between municipal and national levels of government and bypassing of local authorities. Four national plans were then presented suggesting efforts were being made to address policy gaps revealed by the floods on areas that include strengthening economic and social development, water management, and disaster prevention, mitigation and risk reduction activities. The layer concluded with analysis of the economic impact of the flood, concluding that daily wage earners were one of the most impacted groups, and that greater livelihood support was necessary to assist poorer people to meet basic needs.

The movements and public open spaces layer analysed the use of roads and public open spaces during the flood, concluding that transport mobility was essential for enabling income generation to continue. A number of key informants in the Bang Bua Canal travelled to functioning markets to buy goods for resale within their local neighbourhoods via home-made or donated rafts. While many of the public open spaces flooded, bridges untouched by the floodwater provided space for neighbourhood services to be carried out such as food kitchens and distribution centres. Valuables such as motorcycles were also stored in public open spaces.

The plots layer analysed how the impact of the upgrading on individual and neighbourhood plots. Mortgages and land rental debts were frozen for one year, alleviating the financial pressures on people in the Bang Bua Canal, crucially reducing some of the financial risks associated with upgrading. In terms of governance, the plots layer highlighted how development mechanisms such as the Canal Network were essential to managing an efficient and effective response. The network became so important that it grew in membership from its original 17 neighbourhoods to 38 by the end of the flood. Linked to the success of the network is

leadership and the ability to self-organise in a way that is inclusive and participatory.

The buildings and services layer analysed the ways in which the quality of a building determined vulnerability to flooding and the role of government in meeting basic needs during the flood. One of the key conclusions from this layer is that low-income people in the canals were one of the worst affected groups because flooding first began in the canals and lingered there the longest. The most vulnerable groups included people who lived in one-storey homes, were unemployed, illegal migrants or had mobility challenges such as the elderly, children and PLWD.

A primary coping strategy for such people was to move to evacuation centres to access services and meet basic needs; however, 'hidden' populations such as migrants were not assisted through evacuation centres and were at risk of being forgotten by response agencies.

Finally, the building and services layer concluded that while district government authorities were primarily responsible for looking after the needs of the neighbourhoods in their areas, they lacked experience in disaster response, resources to meet needs and were often not coordinated with when agencies and private individuals provided assistance.

This analysis in this chapter highlights that preparedness and response actions within the Bang Bua Canal were more coordinated and effective than those by the government at the district, municipal and national level. The evidence supporting this conclusion is found at the different morphological layers, suggesting that over a decade of development work targeting social, economic and governance structures enabled canal

dwellers to adapt their systems to a flood event with an overall degree of success.

However, the actions and activities of individual neighbourhoods differ from one location to the next, depending on the neighbourhood's history, its social dynamic, governance structures and economic arrangements. How and why do they differ?

The next three chapters focus on individual case studies of upgrading actions before the flood and how the systems adapted during and after. The case studies seek to answer understand the drivers of resilience within each individual neighbourhood.

Chapter seven

Case study one – analysis of Bang Bua Neighbourhood

Introduction

The next three chapters will analyse individual case studies, starting with the Bang Bua Neighbourhood in this chapter. This chapter specifically seeks to analyse ways in which economic, governance and social CAS influence different morphological layers in order to establish dimensions of resilience before, during and after the flood in Bang Bua Neighbourhood.

The chapter begins with a profile of Bang Bua Neighbourhood. It then seeks to explain how economic, governance and social systems interacted at four morphological layers before, during and after the 2011 flood. Concerning the topographical layer it is explained that, due to the small geographical space of the case studies, typological analysis for all three neighbourhoods can be found in Chapters Five (everyday risks in the Bang

Bua Canal) and Six (the impact of the 2011 flood). Regarding the movement networks and public open spaces layer, analysis shows the importance of investment before and after a disaster in order to ensure a basic level of functionality occurs during a crisis. The plots layer demonstrates the value of transparent and accountable economic and governance systems, and how high levels of trust are at the centre of making economic and governance systems work well. The buildings and services layer analyses the ways in which a strong built environment supports people during a disaster and aids in their economic and social recovery. Lastly, this chapter explains how the key findings were tested with the neighbourhood residents in order to validate the dimensions of resilience as perceived by residents in the Bang Bua Neighbourhood.

Methodological approach of this chapter

The methodological approach for the analysis of the Bang Bua Neighbourhood consisted of two main methods: morphological analysis, and coding (using of NVivo software). Maps with information about building use, upgrading plans, roads, electrical grids and pipelines for water and sewerage were the primary morphological tools used. Systems analysis was conducted primarily through coding with NVivo software to analyse key informant interviews and focus group discussions. Furthermore, where possible, contextual information gathered through key informant interviews, participant observation, PRA tools such as timelines of the flood and a household vulnerability assessment was also coded. Transect walks with residents were undertaken in order to triangulate information, and key observations were documented through journal writing.

7.1 Neighbourhood profile

Bang Bua Neighborhood is well known for its upgrading success, and is often visited by other neighbourhoods participating in upgrading and

researchers as a study of good practice. It registered as a formal neighbourhood in 1993 (BB4, a middle-aged man). There are 229 households, most of which were reconstructed during the upgrading programme within three years, of which one year consisted of building a collaborative community vision and land sharing negotiations. The neighbourhood agreed to join the Baan Mankong programme, to form a savings group and to legally register as a cooperative. The cooperative negotiated a 90-year lease agreement for the land. As shown in Figure 7.1.2 below, the neighbourhood shares a property line with a military base. Bang Bua Neighbourhood residents come from a range of backgrounds. Approximately ten per cent of the people work for the government, ten per cent as employees in businesses and 70 per cent as daily wage earners (K120, a middle-aged woman on the leadership team, confirmed by other interviewees). A total of 20 households were interviewed in the research resulting in a baseline survey of eight per cent. Three focus group discussions were also conducted; the first with 18 people on 21 February 2014, the second with 13 people on 2 March 2014 and the third on Aug 10 2014 to test findings with 13 people.

Before the 2011 flood affected the Bang Bua Canal, people from the leadership committee traveled to the north of Thailand to support peer groups from the Baan Mankong Network, who were already experiencing the flood. Interviews with local residents determined that the flood lasted for three months in Bang Bua Neighbourhood. The water started off at a level of approximately 0.6 meters, and after a month reached between 1-1.5 meters before it began to slowly recede (BBFGD2). Seven days passed before external assistance arrived in the neighbourhood (BB4, a middle-aged man in leadership; BBFGD2). Ensuring people had enough food was one of the key issues raised by residents (BBFGD2). The other most frequently raised issue was finding money after the flood to pay debt, restart livelihoods and repair homes. Figure 7.1.1 below is a photograph of

Bang Bua Neighbourhood in 2014, three years after the flood event took place. Figure 7.1.2 is a building use map from the Bangkok Metropolitan Authority that shows Bang Bua Neighbourhood located between a military base and the Bang Bua Canal. Having described Bang Bua's Neighbourhood profile, the chapter will next analyse the topography layer.



Figure 7.1.1 Bang Bua Neighbourhood shows no signs of the 2011 flood, three years after the event took place. Source: the author

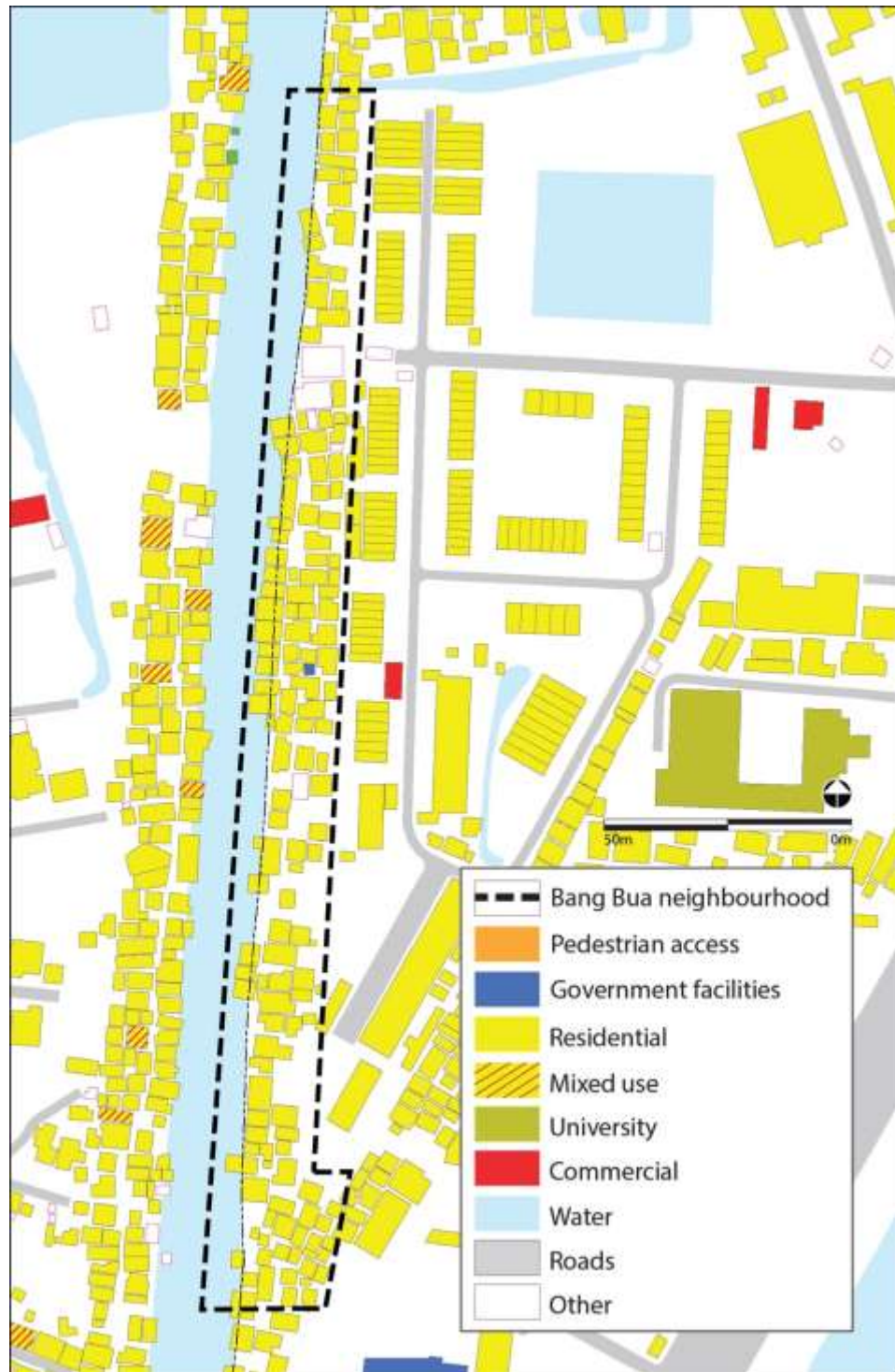


Figure 7.1.2: A building use map from the Bangkok Metropolitan Authority that shows Bang Bua Neighbourhood located between a military base and the Bang Bua Canal. Residential buildings are indicated in yellow. Source: (Department of City Planning, 2014a).

7.2 Topography

Due to the small geographical location of the research of three kilometres, the topographical analysis of the entire Bang Bua Canal was conducted in Chapters Five and Six through a systems and morphological analysis of Bangkok, and will therefore not be repeated in this chapter. This chapter will now focus its discussion on Bang Bua Neighbourhood's movement networks and public open spaces in order to investigate dimensions of resilience.

7.3 Movement networks and public open spaces

Analysing movement networks and public open spaces creates further understanding of how Bang Bua Neighbourhood links with wider mobility and public open spaces in Bangkok. During the flood, roads, streets, pedestrian lanes and public open spaces used by residents from Bang Bua Neighbourhood were submerged in water. While movement networks and public open spaces did not play a large role during the flood, they were significant in building resilience before and after the flood.

7.3.1 Road accessibility

The roads in Bang Bua Neighbourhood received little to no damage during the flood due to robust, sustainable construction techniques used in the neighbourhood upgrading as shown earlier in a photo in Figure 7.1.1. Therefore, when the water receded, residents were able to immediately access parts of the city to purchase food and water, resume employment, attend school and carry out daily life.

Before the upgrading occurred, one key informant, an academic, described Bang Bua Neighbourhood's pedestrian lanes as 'narrow and twisted' (KI30). Today, Bang Bua's main pedestrian lane is made of concrete, is three meters wide and 629 meters long, and is situated parallel to the

canal (as shown below in Figure 7.3.1a). The lane is covered with intermittent humps to protect pedestrians from motorcycles traveling too quickly. The canal-based pedestrian lane was built after houses moved from the canal bank onto land. The sides of the canal were reinforced to prevent subsidence and an elevated pedestrian lane was built. This lane is a source of pride for the Bang Bua Neighbourhood, and was often mentioned as an indicator of success by residents from Saphan Mai and Roi Krong Neighbourhoods.

The smaller alleyways, also made of concrete, are two meters in width and 537 meters in length, and are built around mini blocks to further open up access as shown in Figure 7.3.1a below. The main entrance to the neighbourhood is from Phaholyothin Road, Soi 49/2, through a military base. It is a shortcut into the neighbourhood negotiated by a former neighbourhood leader and a local politician (Wungpatcharapon and Tovivich, 2012b). Figure 7.3.1b below is a photograph of the new entranceway to Bang Bua neighbourhood via the military base shortcut. Prior to the development of the shortcut, access to Bang Bua Neighbourhood was through a much longer walk via a road on the southern side of the canal.



Figure 7.3.1a: This map of Bang Bua Neighbourhood indicates primary pedestrian lanes (with motorcycle access) in red and alleyways in yellow. Source: (Bang Bua Neighbourhood, nd-d)



Figure 7.3.1b: This photograph shows a pedestrian size entrance to Bang Bua Neighbourhood via the shortcut through the military base. Source: the author

7.3.2 Public open spaces

Public open spaces such as playgrounds and open green spaces around the library and community building were flooded and therefore unusable for the duration of the flood. However, they were essential for neighbourhood residents to access during their recovery as a means of 'returning to normal'. For example, at the centre of the neighbourhood lies a designated open space next to a sacred Tamarind tree shown on a map in Figure 7.3.1c and in a photograph in Figure 7.3.1d below. Usually 20-25 children up to the age of 12 play together in this open space between 17:00-19:00 on a daily basis. The children use the tops of bottles or their own shoes to play games, oftentimes supervised by a group of socialising adults. A child returning to his or her regular routine is an important way to establish a sense of stability after a disaster (Phongnongsung and Borchard, 2012). A second public open space often used is the compound around the community centre where adults tend to meet and have conversations while children play with outdoor recreational equipment (shown in the map in Figure 7.3.1c below). A third space is in front of the library, also indicated in Figure 7.3.1c below.

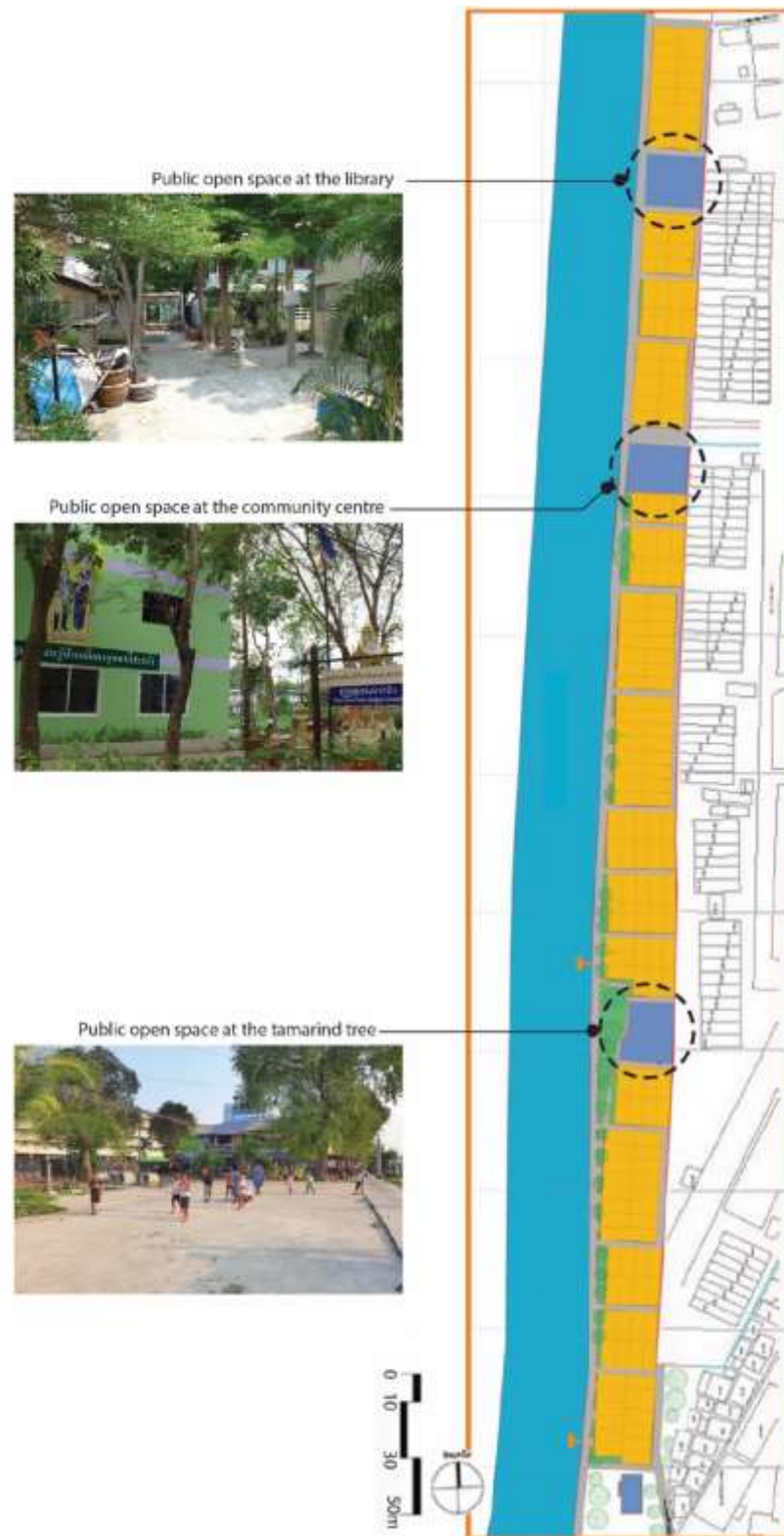


Figure 7.3.1c: This map of the planned reconstruction in Bang Bua Neighbourhood indicates houses in orange and public open spaces located in front of the library in blue (top), at the community centre (middle) and next to the Tamarind tree (bottom). Source: (Bang Bua Neighbourhood, nd-e)



Figure 7.3.1d: A photo of the open public space that was cleared for children to play safely in the centre of the neighbourhood instead of in parking lots. Source: the author

Having discussed the influence of economic, governance and social CAS on roads and public open spaces, several key dimensions of resilience stand out. Firstly, improvement in the quality of roads and public spaces resulted in a safer environment. Secondly, social identity was enhanced through feelings of pride for having achieved a pedestrian lane that runs parallel to the canal. Thirdly, construction of safer roads and public open spaces arose from the neighbourhood's ability to take collective action. Fourthly, a sense of social cohesion assisted the neighbourhood with taking collective action to build safer lanes and new public open spaces. This chapter will now focus on the way in which plots in Bang Bua neighbourhood were influenced by CAS before, during and after the flood.

7.4 Plots

Having explained the key dimensions of Bang Bua Neighbourhood's movement networks and public open spaces before, during and after the flood, this section on plots will now interrogate the ways in which the plots layer changed over time. An analysis of the way in which CAS shaped and transformed plots in Bang Bua Neighbourhood are presented.

A land rental agreement was secured for Bang Bua Neighbourhood in 2004, allowing residents to make significant investments in economic, governance and social systems that seemingly contributed to a more effective response to the flood and a quicker recovery time. Before the flood struck, architects, planners and development workers from CODI collaborated with Bang Bua Neighbourhood residents to re-order neighborhood plots. The neighborhood developed categories such as a 'pet friendly zone', which was far away from the 'party zone' because animals tended to get upset by the noise from party makers (BB20, a middle-aged woman). Families and friends were given the option to remain where they were or to shift plots in order to live near one another. Figure 7.4a below shows the categories that were used as the basis for re-blocking plots through participatory planning. Purple is people who were willing to sacrifice their land; pink for a group of people that liked gambling; yellow for 'landlords' who rented out rooms in their homes and were the last ones to join the upgrading; blue for another group of owners that identified itself differently from the yellow group; green for vendors; and orange for relatives of people living in the next neighbourhood. Not all residents in the neighbourhood agreed to participate at the start, but the programme went ahead with the belief that others would participate once they saw physical evidence of positive change. Figure 7.4b shows how the plots looked after 100 per cent of the re-blocking took place. Each household agreed to pay 50 Baht per month towards the cost of renting the land (BB1, an elderly man; BB20, a middle-aged woman).



Figure 7.4a: A map of Bang Bua Neighbourhood before the re-blocking of plots took place. Each colour signifies a group of houses that shifted their plots to live next to each other. Source: (Bang Bua Neighbourhood, nd-a)

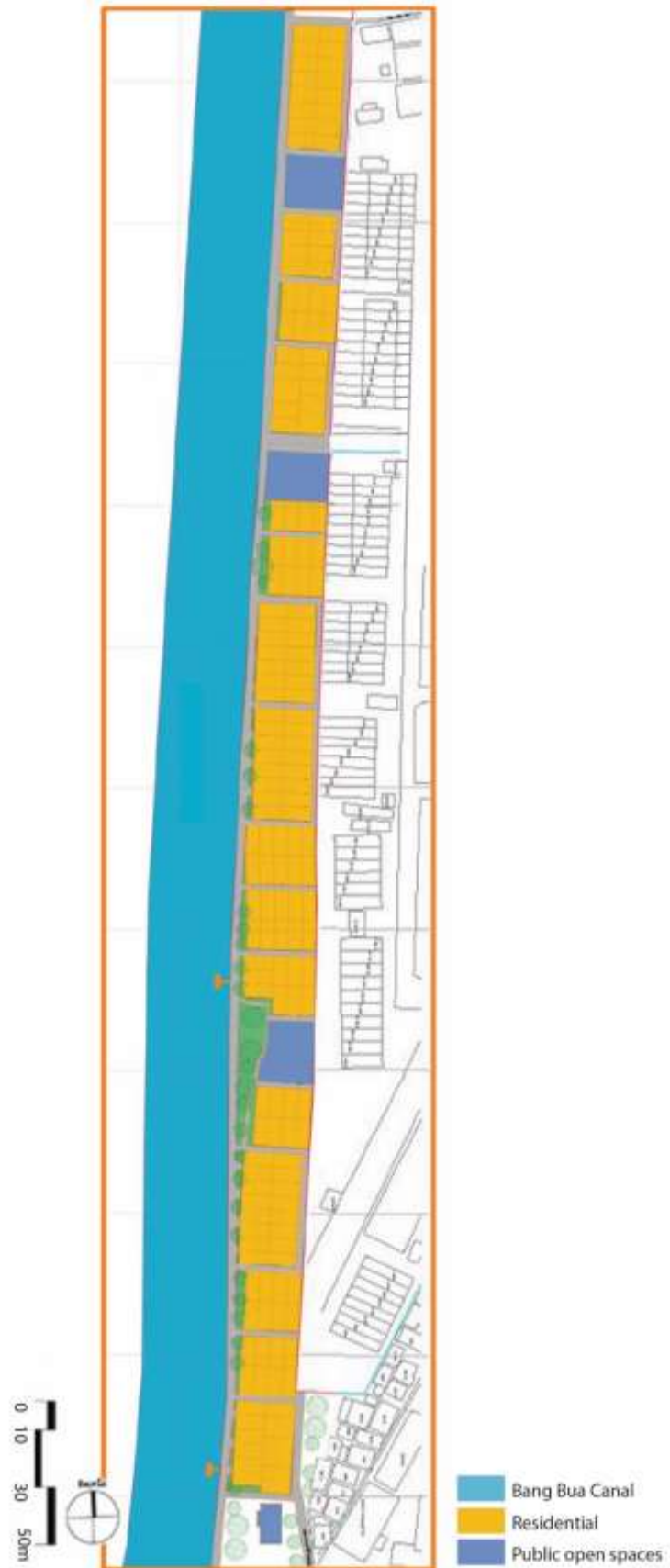


Figure 7.4b Bang Bua Neighbourhood after 100 per cent of the re-blocking.
Source: (Bang Bua Neighbourhood, nd-e)

7.4.1 Savings groups

The neighbourhood savings group was active before, during and after the flood. Years before the flood occurred groups such as a women's catering enterprise, a construction workers group and a youth club were formed during the upgrading process. The groups gave an otherwise economically vulnerable group of people an opportunity to build social capital, earn extra income and learn new skills. One academic key informant said, 'during the neighbourhood construction they [CODI and its partners] engaged a lot with jobless youth and women. Residents became skillful builders after the programme, and that has become an occupation for former jobless residents. I think it was a very rich experience for residents' (KI30, 2014).

During the flood, money saved for welfare activities enabled basic needs to be met through the establishment of a food kitchen. After the flood receded, access to loans through the savings group made it possible for people to repair damage to their homes or use cash in hand to re-start their small businesses such as food vending. An overwhelming majority of people interviewed said one of the biggest challenges during the flood was unemployment, but received supplementary income from some of the livelihood activity groups started up years before the flood.

After the flood some people said they went back to their previous jobs but relied on supplementary income from the livelihood groups that were set up during the upgrading (BB6, a middle-aged woman; BB18, a middle-aged woman). Therefore, livelihood skills and activities that were started before the flood occurred proved to be a financial cushion for people who needed to diversify their income generation strategies after the flood. The livelihood groups provided a flexible way for people to earn additional cash to supplement their individual income earning activities.

7.4.2 Governance structures

Due to the large size of the neighbourhood, sub-committees were initially set up to collect census data about the households to assist with upgrading activities. During the flood, the data census sub-committee system started back up but adapted itself to the flood by collecting information about needs in relation to food and non-food supplies such as medicine and hygiene products. It therefore became an important mechanism for monitoring and responding to needs. One sub-committee leader was assigned responsibility for tracking information related to four to five nearby households (BB18, middle-aged woman). The sub-committee leader was expected to attend a small number of community meetings in order to update information on needs and people evacuating or returning to the neighbourhood. The sub-committee leaders were also asked to be present when aid was delivered and divided in order to establish an additional layer of transparency and accountability (BB18, middle-aged woman; BB4 middle-aged man). Therefore, evidence of pre-existing neighbourhood governance structures adapting to guide the flood response of the neighbourhood can be seen.

Strong leadership was cited as a factor for increasing the efficiency of the flood response. As was stated earlier, people within the leadership team volunteered their time in a flooded area north of Bangkok to gain experience from their peers and set up a response system locally before the flood arrived. One academic key informant (KI30) believes that Bang Bua Neighbourhood's strong leadership in the flood comes from ten years of problem solving chronic stresses together before the flood. He said, 'Because of Baan Monkong they [Bang Bua Neighbourhood] kept practicing problem solving together and became united at a deeper level. I think this was achieved not only by the group work, but also by the community leader himself. He contributed a lot' (KI30, 2014).

The elected leader of Bang Bua Neighbourhood was also selected to lead the Baan Mankong upgrading programme. The overlap in leadership is seen as a strength by most residents interviewed because it aligns the elected committee, recognised by the government, and the upgrading committee, ultimately improving the way they work together. According to one academic key informant (KI30), the leader demonstrated faith in the upgrading process, was the first to remove and rebuild his home, and exemplified selflessness by giving up seven personal plots of land for other people to occupy. As a result of his actions, the leader was viewed with great respect. The academic key informant said, 'He [the leader] was the one who tore down his house first. That was one of the key triggers that convinced people. They had no excuses for backing out because the leader had assumed all the risk. He was smart enough to give people jobs to do in the design and construction phase ... he has strategic thinking. The people he was leading were busy with their regular jobs. It's very skillful thing to lead people into extra work' (KI30, 2014).

Evidence of Bang Bua Neighbourhood's strong leadership is also demonstrated by the strategic planning of their social welfare system. It soon grew beyond assisting with funeral costs and school fees into providing free social housing in low-rise apartment blocks for elderly tenants, the only neighbourhood in the canal known to provide this level of support for the elderly.

However well people in leadership positions preformed, there were still suspicions of corruption (BB2 a middle age-woman; BB20 a middle-aged woman). As one member of the leadership committee said, 'People are suspicious when we buy something new. We have to prove that the cooperative's account balances and be open to answering questions about finances from anyone' (BB2, 2014).

Politics reflecting the political unrest in Bangkok in 2014 were described as having the potential to cause a deep divide in this neighbourhood. While vote buying has been present in Bang Bua Neighbourhood for a long time, the political stakes were high in 2014 as protestors tried to remove the government from power. Supporters from the opposition and governing parties reside in Bang Bua Neighbourhood, and reflected the political divisions in the country at the time. As one middle-aged man in a leadership role said, 'Twenty years ago we used to be cousins and friends, but now we are separated by political differences because politicians buy votes here' (BB4, 2014). He went on to describe the importance of putting politics away in order to achieve progress in the neighbourhood, 'If we are strong enough we can be one in balance with politicians, not waiting around for them to support our development work' (BB4, 2014).

7.4.3 Social dynamics

A high level of trust appeared to be evident throughout the neighbourhood before the flood. When asked why people trusted one another one middle-aged woman responded by saying, 'we have trust here because certain people are strong and patient. To build trust you have to craft your words carefully, participate in activities to get to know one another and work together on important issues'. She cited the celebration of Mother and Father's Day, and the use of the neighbourhood boat as special events that encouraged people to meet and build relationships.

Physical progress from the Baan Mankong upgrading programme appears to have also developed trust amongst Bang Bua Neighbourhood residents. When one middle-aged woman was asked how she felt about the impact of the neighbourhood upgrading she said, 'progress cannot cease; it makes me proud so I keep doing it' (BB2, 2014, a middle-aged woman). Feelings of pride, respect and dignity were common words used to describe the progress of the upgrading work. Another middle-aged woman said, 'I'm

proud of what we've done, even if I didn't make any money from it' (BB18, 2014). Rewards of recognition were given to people who went beyond what was expected of them. For example, individual waste management awards can be seen on placards on the front doors of some houses, incentivizing families to continue with wise waste management processes. Another middle-aged woman reflected that there was less conflict now that plot boundaries were clear. She said, 'in the past there were daily fights about who could access and use certain areas' (BB20, 2014).

Overall, the ability to self organise appeared to be empowering for Bang Bua Neighbourhood. As one focus group discussion concluded (BBFGD2), children have more protection now that they play in the protected public space instead of parking lots, people have more and better jobs, some homes can afford the Internet and there has been a reduction in social problems such as fewer arguments and less drug trafficking. In summary, social dynamics within Bang Bua Neighbourhood improved as levels of trust increased between residents.

Having explained the influence of different economic, governance and social CAS in the plots over time, several key dimensions of resilience can be identified. Firstly, the presence of land tenure made investment in individual and neighbourhood infrastructure and systems a secure investment. Secondly, a transparent and accountable savings group made it possible for residents to access affordable loans.

Thirdly, an effective neighbourhood governance structure managed the upgrading process and other day-to-day neighbourhood issues. Fourthly, a high degree of social capital was developed through collective activities. The next section discusses the ways in which CAS shaped buildings and access to services over time.

7.5 Buildings and services

Effective economic, governance and social processes created strong buildings and services that were able to withstand the flood and allowed the community to ‘bounce back’ quickly. This section explains the qualities of the homes and their access to electricity and water as well as the way in which the community centre was at the heart of the flood response and remains important to this day.

7.5.1 Robust homes

Most of the residents in Bang Bua Neighbourhood remained in their own homes when the flood hit. Almost all of the houses have at least two stories (as shown in Figure 7.5.1b), giving families a place to retreat to from the floodwater. As discussed in the plots section above, basic needs were met through voluntary work carried out by sub-committee leaders. Ultimately, conditions within Bang Bua Neighbourhood were better than those in the evacuation centres.

After the floods, houses received minimal damage due to strong, concrete foundations and good overall construction. Floodwater damaged household items such as beds, furniture and doors, but none of the houses collapsed, as was the case in other neighbourhoods. Residents spent their own savings and government flood compensation money to repair the damage to their homes.

Prior to the flood, housing radically changed in Bang Bua Neighbourhood. Since 2004 many of the wooden shanties have transformed into well-constructed homes. Most of the homes now have two stories; wealthier families have three stories. While the design may differ, the structures all have concrete floors and walls as shown in Figure 7.5.1a below. Nearly all of the homes in the neighbourhood measure five meters by ten meters squared, and were built with loans of up to 150,000 Baht (GBP 2,779).

Families with more than eight people have homes that are seven and a half meters by ten meters squared with loans of up to THB 186,000 (GBP 3,445). Loans were granted to people who could provide a ten per cent down payment.

Size	Cost in Baht	Total Cost GBP	Yearly Cost	Daily Cost
5x10	150,000 Baht	£2,779.00	£185.00	£0.50
7x10	186,000 Baht	£3,445.00	£230.00	£0.63

Table 7.5.1: A table of the size of houses built in Bang Bua Neighbourhood and the costs associated. Source: the author

Terraces and balconies are common across most of the houses. Groups of friends meet and socialise on their terraces or ‘sala’, a Thai word used to denote a gazebo-like structure that provides shade from the sun. Elderly people socialise together on the ‘sala’ while they look after young children. Several of the ‘sala’ are located on the canal bank, not having moved during the redesign or having been built subsequent to the reconstruction of the neighbourhood.

Making vulnerable homes safe

When asked to explain what a strong, safe house looked like, eight people in a focus group discussion (BBFGD2) were asked to draw houses (Figure 7.5.1a) indicating qualities that are frequently seen in the neighborhood (Figure 7.5.1b). Their perceptions of ‘strong’ and ‘safe’ were for the most part realised by the reconstruction of houses through Baan Mankong’s upgrading.

Many of the values of a strong house related to flood risk reduction. For example, a cement foundation was prioritised because it was able to withstand flood damage better than wood; it also made a house safe from fire. Having a house with two stories was valued because it permitted the

storage of valuables out of reach of floodwater. A toilet on the first floor was also prioritised because it ensured continued use of a toilet in the event of a future flood.

A terrace for outdoor living was also listed as important because it was a primary place for socialising as shown in Figure 7.5.1c. Lastly, mobile furniture instead of the type of furniture built in into the wall was deemed crucial for avoiding flood damage.

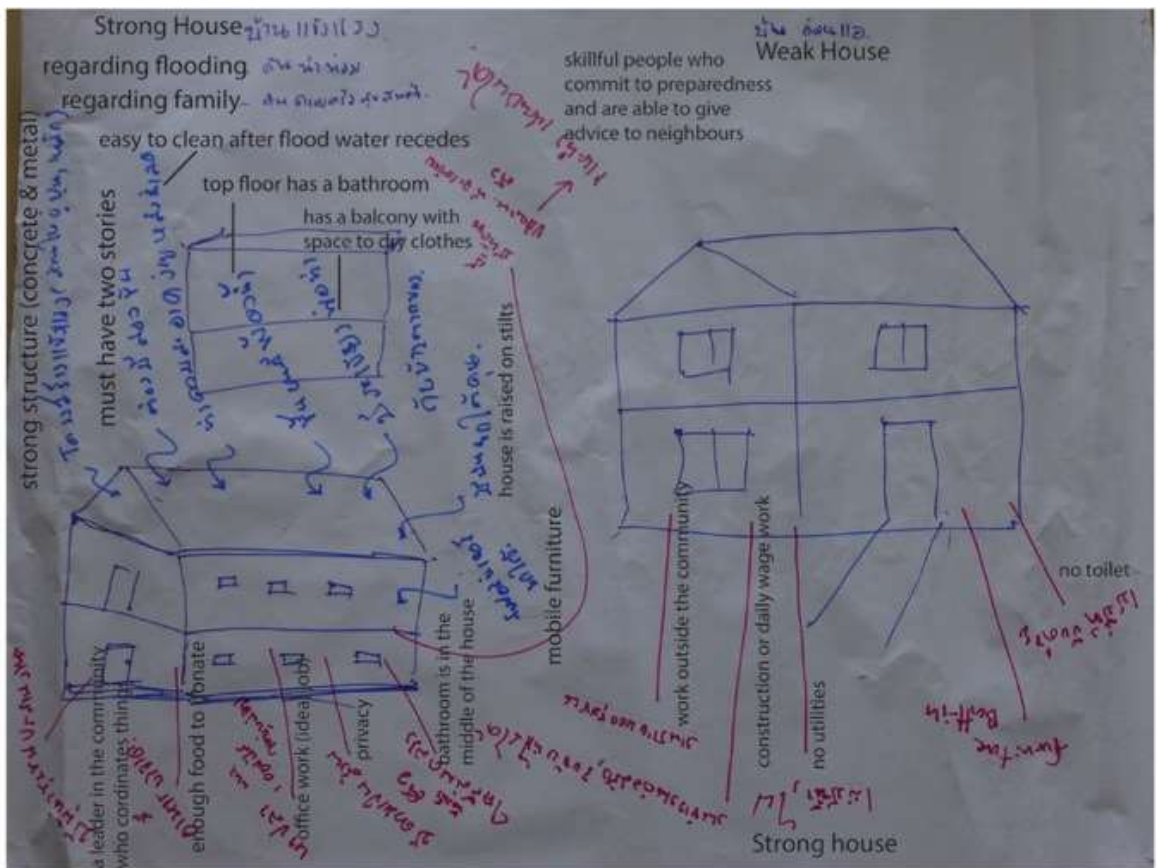


Figure 7.5.1a: A drawing of strong, safe houses, created during a focus group discussion (BBFGD2) with eight Bang Bua Neighbourhood residents. The drawing highlights the difference between perceptions of a strong home (blue) and a weak one (red). Source: Bang Bua FGD2 on 2 March 2014



Figure 7.5.1b: Qualities described in the picture created by participants in the focus group discussion mentioned above can be seen in the actual houses in Bang Bua Neighbourhood. For example, two and three storey homes with cement foundations and frames as shown in this photo of Bang Bua Neighbourhood. Source: the author



Figure 7.5.1c: A terrace or 'sala' for outdoor socialising was listed as an important quality of a house. Source: the author

Making vulnerable people safe – the role of welfare homes

Older people with mobility constraints live on the bottom floor of two apartment blocks built for people who were previously renting rooms in Bang Bua Neighbourhood and who continue to do so today. The rules that govern the upgrading process state that people who have been renting in Bang Bua for a period of five years or longer have the right to stay in the neighbourhood by renting an apartment in one of two low-rise blocks of flats. After ten years the tenants are given the right to own the apartment. A total of 10 families currently rent (BB20, a middle-aged woman). The income from the rental payments in combination with an initial small grant from CODI (Wungpatcharapon and Tovivich, 2012a) finances the welfare homes occupied by the elderly.

The process of building safer, stronger homes has fundamentally changed the way people in Bang Bua Neighbourhood see themselves. One academic key informant said, 'Bang Bua is different from other communities like Roi Krong, because 100 per cent of the people moved their homes from the water. This process of reconstruction has changed the identity of the people from the core, and in the best of ways' (KI30, 2014).

7.5.2 Access to services

Access to running water and electricity was available to those who had two storey homes. Electricity was shut off on the bottom floor only. Toilets however, were much more problematic, as many people had toilets on the ground floor, and not on the second storey. After the floodwater receded, water, electricity and sanitation facilities worked as efficiently as they had before the flood.

Electricity and water have been available in Bang Bua since 1985, but the upgrading enabled the development of an improved system whereby each

registered household now has a meter that monitors its consumption (BBFGD1; Bang Bua focus group discussion; BB1, an elderly man; BB2, an elderly woman; BB4, a middle-aged man) as shown in Figure 7.5.2a below. Each household also has access to water and a drainage system. The main water supply is a pipe 1.5 meters in diameter and 650 meters long. A sub-water line one meter in diameter has been laid to reach the houses in the back of the neighbourhood as shown in Figure 7.5.2b. The main drainage system is 0.6 meters in diameter and 538 meters long. There is a smaller sub-drain that runs through the back portion of the houses as shown in Figure 7.5.2c. Each house has a septic tank that filters waste water before it enters the canal, thereby reducing the neighbourhood's pollution footprint.



Figure 7.5.2a: Meters for water and electricity (right) monitor consumption for individual households. Source: the author

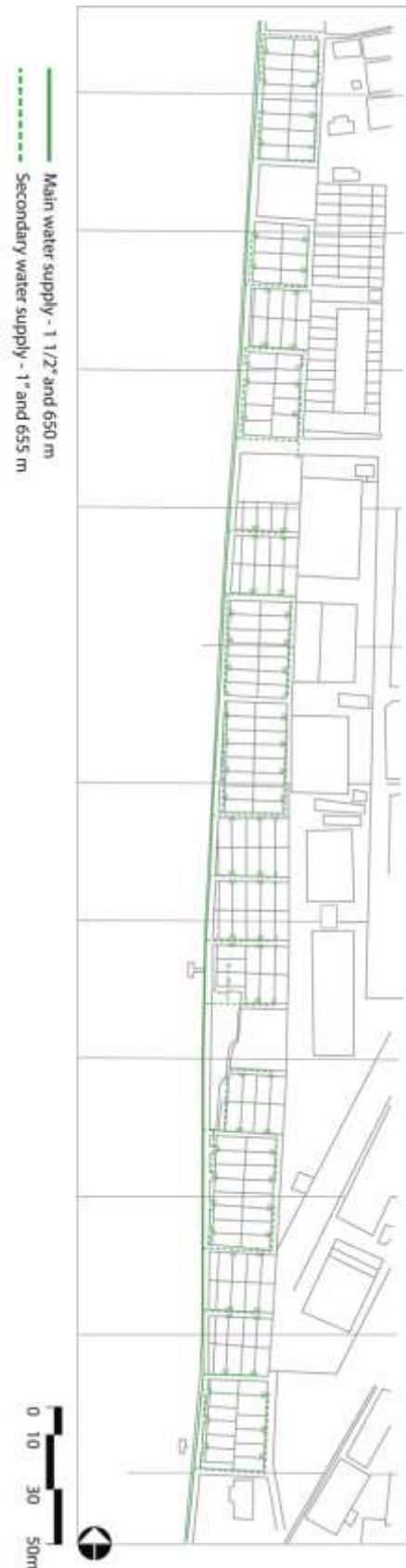


Figure 7.5.2b: A map of Bang Bua Neighbourhood's water supply shows the main pipe (indicated in solid green) is located on the canal side, and that smaller pipes (indicated in dotted green lines) have been laid to service houses further from the canal. Source: (Bang Bua neighbourhood, nd-b)

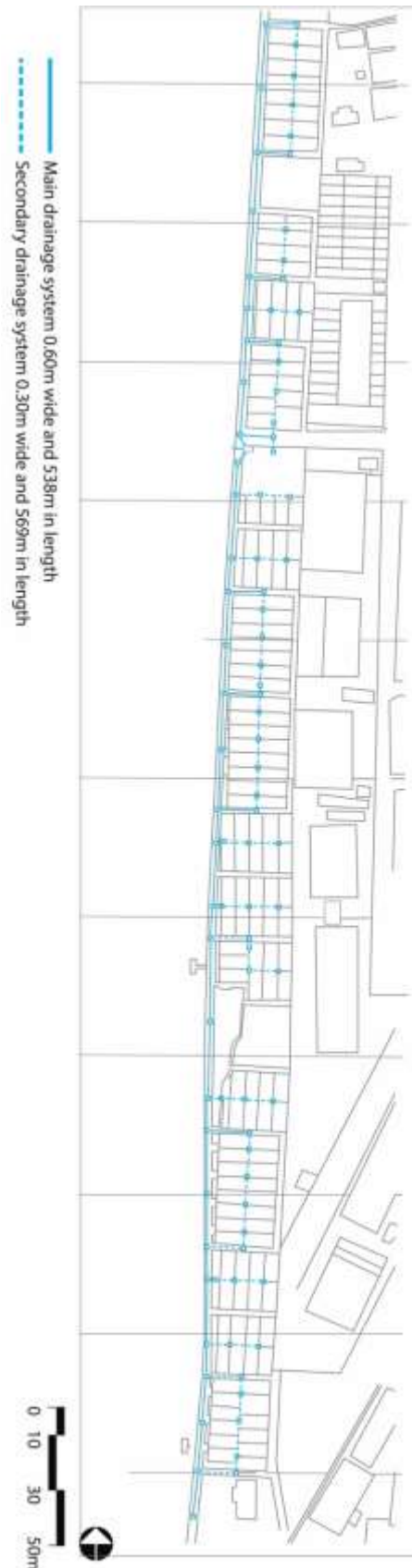


Figure 7.5.2c: A map of Bang Bua Neighbourhood's drainage system shows the primary drainage pipe (indicated in solid blue) is located along the canal, and that smaller pipes (indicated in dotted blue lines) have been laid to service houses further from the canal. Source: (Bang Bua Neighbourhood, nd-c)

As a result of formalising land tenure, daily garbage collection services have become available by a Bang Khen district government boat that empties bins placed on a small jetty that extends from the canal sidewalk (see Figure 7.5.2d). Residents are responsible for placing rubbish in one of several central collection points. On a weekly basis the Bangkok municipality clears the canal of weeds in order to improve the water flow and reduce flood risk (see Figure 7.5.2e).



Figure 7.5.2d: The upgrading included a waste collection service by the district government. A government boat accesses the waste from a jetty. Source: the author



Figure 7.5.2e: Weekly weed collection by the municipal government improves canal water flow. Source: the author

7.5.3 The role of the community centres

Bang Bua Neighbourhood has two community buildings – a library and a community centre. The community centre was essential to coordination and collaboration throughout the flood response. Donations for Bang Bua Neighbourhood and the wider canal arrived at the community centre to be sorted and shared. Flood response meetings were held at the community centre throughout the three-month flood period. Furthermore, the community centre was a place where information such as census data and needs was stored and shared with response stakeholders.

Prior to the flood, the community centre was essential to the growth and development of the economic and governance systems seen in the neighbourhood today. The community centre is a large multi-purpose building, funded partially by the community and partially by donations from different organisations and individuals (KI20, a middle-aged woman). It is located next to the main entranceway to the neighbourhood. Residents pass the community centre on a regular basis, and are free to use the garden and shrine located in the public open space that envelops the immediate parameter. Figure 7.5.3a below indicates the community centre is located next to the main entrance in blue.

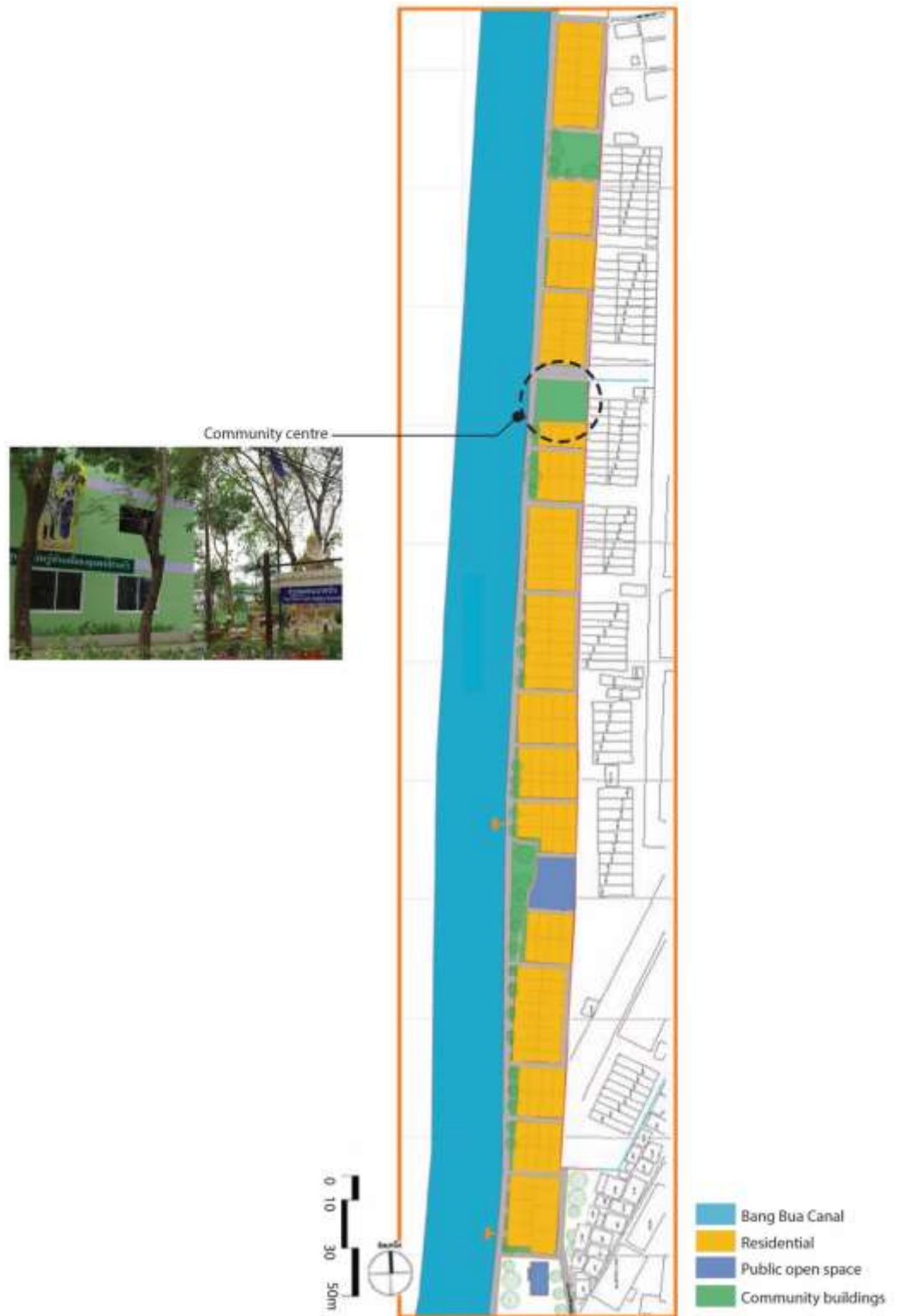


Figure 7.5.3a This map shows Bang Bua Neighbourhood’s community centre (blue) is located near the main entrance. Source: (Bang Bua Neighbourhood, nd-e)

The community centre in Bang Bua Neighbourhood is the biggest and most elaborate among the three neighbourhoods studied, so much so that it serves as the Bang Bua Canal Network's meeting location. The centre is a two-storey building with the capacity to hold meetings for over 100 people in the lower level and up to 30 people in an air-conditioned room on the second storey. While the building is not yet finished, it has a small kitchen and toilet with running water on the second floor, and is in the process of building a large kitchen on the bottom level. The community centre is used by livelihoods groups discussed at the plots layer such as a woman's small catering business and a youth group who use the rooftop to grow vegetables to sell to local schools. It is also used by the Bang Bua community network to host network meetings; by the community to update savings group members; and by children who use it as a playground. There is a plan to construct a nursery and a learning centre for children on the bottom floor (BBFGD1). Construction for such projects recommences when and as the neighbourhood can afford to expand.

The second community building, shown in Figure 7.5.3b below, is a public library and is shared between Bang Bua Neighbourhood and its neighbouring community, Roonmai Pattana. The library has been built by the Bang Khen district authority as a pilot project. The district pays the equivalent of a GBP 132 per month salary to staff the library on a full time basis (Wungpatcharapon and Tovivich, 2012b). The library was not often frequented by children while the research was carried out because children were at school or seemed to prefer playing in the designated open space next to the sacred Tamarind tree.



Figure 7.5.3b: The façade of the public library in Bang Bua Neighbourhood (top) and the inside (bottom) showing a child friendly environment with books and table to read at. Source: the author

Having explained the influence of economic, governance and social CAS in the building and services layer, several key dimensions of resilience can be identified. Firstly, robust homes reduced vulnerability to floods and other disaster risks. Secondly, the presence of welfare homes suggests strong welfare values were acted upon through good governance mechanisms and transparent savings groups at the plots layer. Thirdly, the formalisation of the neighbourhood and its buildings resulted in an improvement in the of quality services provided by the government such as electricity and water. Fourthly, community buildings offered a place for

neighbourhood collaboration, coordination and learning to take place. This chapter will now explain how the dimensions of resilience identified at different layers were validated.

7.6 Validating findings

As discussed in the morphological layers above, the relationship between CAS systems and different morphological layers revealed key dimensions of resilience within each layer. To test the validity of the dimensions, a focus group discussion was held with 13 residents in order to ascertain how strongly residents agreed or disagreed with the dimensions, and their reasons for doing so. Testing for contradictory or confirmatory observations (Eckstein, 2000) is important to ascertain the relevance of findings. The dimensions identified at the end of each morphological layer were shared in an FGD where neighbourhood participants were asked to agree or disagree, sharing reasons why. As a result of the original analysis and validation, four key conclusions stand out regarding Bang Bua Neighbourhood, and are presented below.

Conclusion

This chapter aimed to identify CAS patterns of influence at different morphological layers in order to establish dimensions of resilience before, during and after the flood in Bang Bua Neighbourhood. The chapter began with a neighbourhood profile of Bang Bua. It then analysed information in four layers covering topography; movement networks and public open spaces; plots; and buildings and services. From the original analysis and validation through FGDs four key conclusions stand out.

Firstly, formalisation of the neighbourhood and its structures gave residents an opportunity to invest in their homes, social relationships and governance structures. When the flood struck, the neighbourhood had

stronger homes that could withstand the floodwater. However, the stronger homes were a symptom of a deeper cause of resilience, which leads to the second point.

Secondly, Bang Bua Neighbourhood demonstrated that its economic systems could support residents during a crisis and provide welfare during periods of chronic stress. The emergency food kitchen and social welfare homes for the elderly are two such examples. The livelihoods groups organised before the flood gave some people supplementary income after the flood, providing a slight financial cushion.

Thirdly, the process of reconstruction transformed Bang Bua's social identity from its core. Investment in social events provided an opportunity for people to get to know one another. Problem solving chronic issues such as pollution, poor quality housing, access to better livelihoods gave people an opportunity to self organise, to connect and to participate in causes that can directly benefit them in the short and long-term.

As the neighbourhood improved, a sense of pride in the changes grew. Awards of recognition were given for exceptional achievements such as waste management, which appeared to be as effective as offering a cash incentive. The ability to self organise arguably reduced the social problems in the neighbourhood because of the ability to adapt neighbourhood economic and political structures to meet evolving needs.

Fourthly, transparent and accountable governance systems allowed the neighbourhood to protect and grow its economic investments. For example, the neighbourhood found it had a bigger political voice when it negotiated a shortcut through a nearby military base. The leadership in Bang Bua Neighbourhood is more decentralised than any of the other case studies. Before the flood, sub-committee leaders participated in collecting

and analysing neighborhood census data. During the flood this transferable skill helped people's needs to be met and ensured the distribution of goods was carried out in a transparent and fair way. The leader took personal risks by giving away property, which built trust amongst residents. The leadership's decentralised structure of involving several layers of people at different levels of activities seems to contribute towards Bang Bua Neighbourhood's effective governance strategy.

Having discussed the dimensions of resilience and drawn key conclusions in Bang Bua Neighbourhood, the next chapter will provide an analysis of the second case study – Saphan Mai Neighbourhood.

Chapter eight

Case study two – analysis of Saphan Mai Neighbourhood

Introduction

This chapter seeks to understand how CAS systems influence and shape different morphological layers in Saphan Mai before during and after the 2011 flood. It is similar to the last chapter where analysis of the specific ways CAS influence different morphological layers in Bang Bua Neighbourhood were analysed in order to identify dimensions of resilience before, during and after the 2011 flood. At the end of each morphological layer key dimensions of resilience in the second neighbourhood, Saphan Mai, are identified.

The chapter starts with a profile of Saphan Mai Neighbourhood (known as Saphan Mai from here on) to give the reader key background details. It then moves to the topographical layer, reminding the reader that the topographical analysis was conducted in Chapters Five and Six because topographical analysis is most appropriate at a city scale. The chapter then discusses the movement networks and public open spaces layer, explaining the importance of mobility and its links to income generation.

Public open spaces are then analysed to determine their value in flood and non-flood times. Then, analysis of CAS patterns of influence at the plots layer explains the importance of transparent financial mechanisms, the flawed nature of Saphan Mai's governance system and the social tensions within the neighbourhood. Analysis of the buildings and services layer, is then presented, identifying the buildings in Saphan Mai that were most vulnerable to flooding and the types that experienced less flood damage. Analysis is also carried out regarding Saphan Mai's access to services and how that shaped the neighbourhood's resilience. The chapter then explains the methodology undertaken for validating the dimensions of resilience with residents in Saphan Mai.

Methodological approach of this chapter

As with the first case study in Chapter Seven, the methodological approach for analysis of data from Saphan Mai consisted of two main methods: morphological analysis and coding (through the use of NVivo software). Coding through NVivo software was used to analyse key informant interviews and focus group discussions. Meanwhile, information from participant observation, transect walks, key informant interviews, and participatory mapping was used to conduct a context analysis. At the end of each day, observations were documented through journal writing.

8.1 Neighbourhood profile

Located in Lak Si District along the west side of the Bang Bua Canal, Saphan Mai is one of the smallest neighbourhoods along the Bang Bua Canal with 106 households located on land that is 235 meters in length and approximately 25 meters in width. The group of houses became an official neighbourhood in 2006 (SM9, an elderly man) when it registered with the district government. During the time Saphan Mai registered as a neighbourhood Lak Si district was encouraging houses in groups larger than 100 to register as a formal neighbourhood. New neighbourhoods

were then asked to elect a leader and a committee to govern the neighbourhood so the district authority had a clear partner to work with on its development aims (KI37, Lak Si District Authority).

The neighbourhood took approximately 14 years to reconstruct all of its households through Baan Mankong. Part of this community did not trust the upgrading process or the leadership that guided it, entrenching it in a deadlock until the 2011 flood occurred. A total of 37 households were interviewed for this research (meaning 35 per cent coverage of households). The elected leader estimates that 35 per cent of people are daily wage earners; 30 per cent motorcycle taxi drivers; 10 per cent vendors; 10 per cent work at a shopping mall; 10 per cent are unemployed and five per cent are business owners. Saphan Mai is a legally registered cooperative and has a 90-year lease agreement on the land. Figure 8.1.a below shows Saphan Mai in the process of re-blocking and reconstructing the last phase of houses. Figure 8.1.b below shows a municipal building use map with Saphan Mai indicated by a black dotted line.



Figure 8.1.a: Saphan Mai in the process of reblocking and reconstructing the last phase of houses. Source: the author

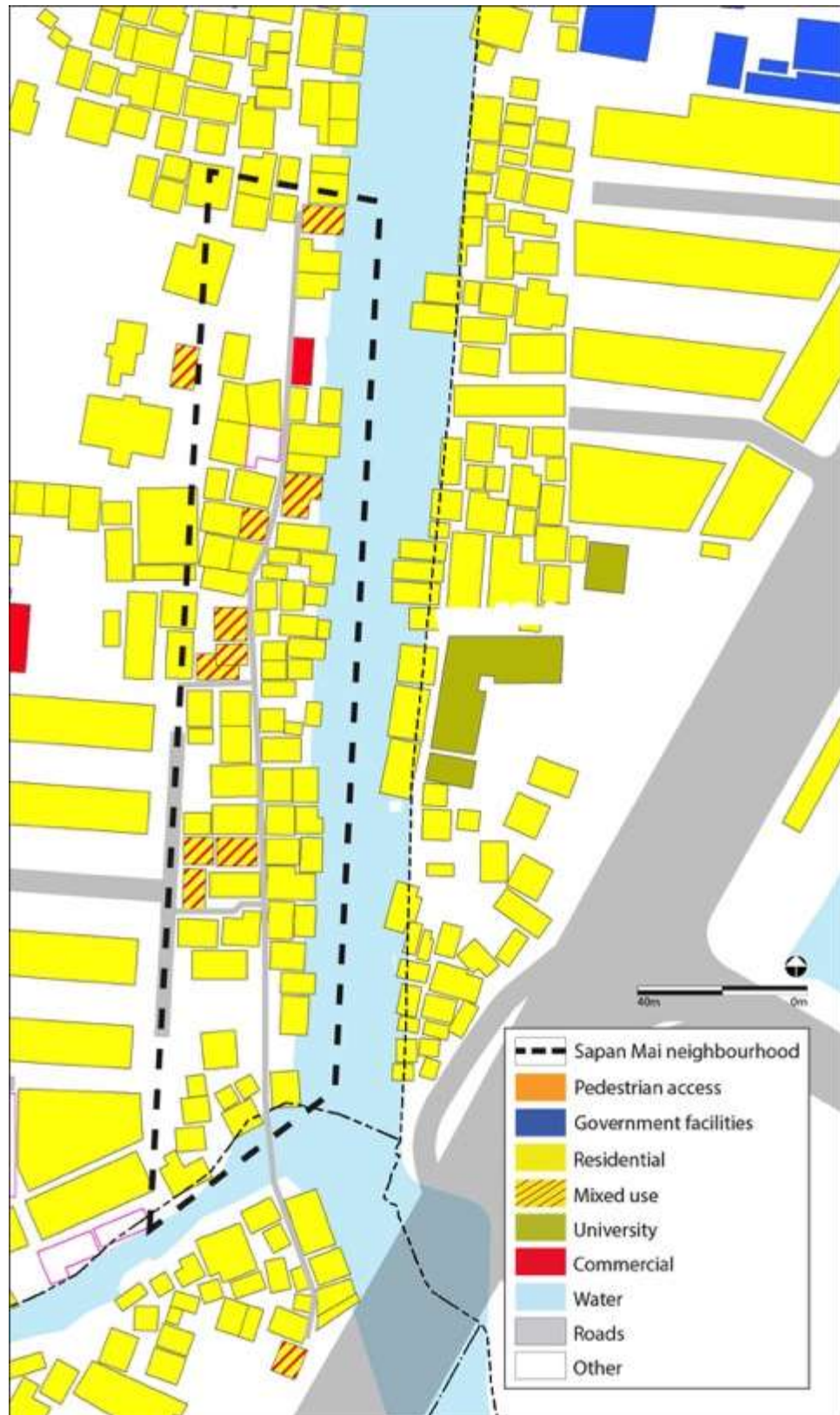


Figure 8.1b: A municipal building use map shows Saphan Mai residential buildings in yellow. Saphan Mai neighbourhood is indicated by a black dotted line. Source: (Department of City Planning, 2014d)

In preparing for the flood, the leader of Saphan Mai says the neighbourhood was able to prepare food for 10 days, although external assistance arrived within seven. The public announcement system was used to warn people that the floods were coming. Residents were advised to leave the area and live with relatives or friends, and to prioritise the evacuation of the disabled, sick people and children. The savings group offered to pay transportation fees for persons who needed to evacuate. Residents were also advised to prepare food and shut off electricity. Help was sought from a nearby monastery, from other neighbourhoods and from the Bang Bua Network. Local aid agencies provided food and non-food items. The leader relied on his personal networks and arranged for friends to bring a pick-up truck of supplies from Roi Et, a city 500 kilometres away.

The main challenges faced in this neighbourhood were related to food and toilets. After the floodwater receded, the biggest challenge raised by most residents was making money to repair their homes, re-start their livelihoods and send their children to school. Today, according to a number of residents, the buying and selling of drugs is still the number one problem in Saphan Mai (SM1, a middle-aged woman; SM2, a middle-aged woman; SM3, an elderly woman; SM4, an elderly woman; SM 12, a middle-aged woman; SM 14, a middle-aged woman; SM16, a middle-aged woman;). While interviews were taking place, six police arrested an accused drug dealer.

Having described Saphan Mai's neighbourhood profile, this chapter will now focus on the topography layer.

8.2 Topography

Due to the small geographical area of the case study, analysis of the topographical layer relating to Saphan Mai has already been covered in Chapters Five and Six where the economic, governance and social influences on the topography were explained in relation to the entire Bang Bua Canal. Therefore, the movement networks and public open spaces will be presented next for analysis.

8.3 Movement networks and public open spaces

After the flood, Saphan Mai expanded its road networks and invested in the development of open public spaces after all residents in the neighbourhood agreed to join the upgrading process. This section will explain the transformation of roads and public open spaces, including after the flood.

8.3.1 Road accessibility

There are three ways to access Saphan Mai. The first is by a wooden bridge that connects the neighbourhood to a nearby highway as shown in Figure 8.3.1a, and is accessed by pedestrians only. The second is through an apartment parking lot into Saphan Mai as show in Figure 8.3.1b. The third is around the back of the apartment block shown in Figure 8.3.1c. Before the upgrading occurred, one main road ran through the centre of the neighbourhood (as show in Figure 8.3.1d) with a collection of small, squiggly footpaths used to access houses beyond the main road.



Figure 8.3.1a: A wooden bridge from a main road offers pedestrian access to Saphan Mai. Source: the author



Figure 8.3.1b: One entrance to Saphan Mai through an apartment parking lot. Source: the author



Figure 8.3.1c: A third entrance to Saphan Mai along the backside of an apartment block. Source: the author



Figure 8.3.1d: There are three entrance points to Saphan Mai, starting with the bridge on the left, and two entrances through an apartment parking lot located in the centre of the map. Source: (Department of City Planning, 2014d)

The roads in Saphan Mai were completely submerged with water during the flood, and therefore transportation was primarily by boat. However, after the flood some residents agreed to shift their plots, giving Saphan Mai the opportunity to widen its main pedestrian lane and build several secondary lanes to improve accessibility to houses.

Part of upgrading or ‘building back better’ after the flood meant expanding the length of the main road as people agreed to move their houses and change their plot shape and size. Smaller alleyways were introduced as the plots of the neighbourhood aligned into rows. Today the primary pedestrian lane is wide enough to accommodate a small motorcycle. Neighbourhood residents say they will request the BMA to construct a waterfront sidewalk like the one in Bang Bua Neighbourhood once the demolition of canal-based housing is complete (SM9, an elderly male engaged with leadership; SM22, an elderly male). The sidewalk can be seen as a potential social connector because it was desired by all interviewees, but for different reasons. One elderly woman wanted the sidewalk because it would make the neighbourhood look ‘beautiful for tourists’ (SM5, a young woman); others wanted it because it was scenic and prestigious like Bang Bua (SM10, an elderly woman; SM22, an elderly man; SM36, a young man); others expressed a perceived sense of reduced risk to flooding because the government has promised to build a retaining wall for the canal bank in addition to the sidewalk (SM14, a middle-aged woman; SM9, an elderly male). A map of the primary pedestrian lane and smaller alleyways is shown below in Figure 8.3.1e. Roads are indicated in gray.

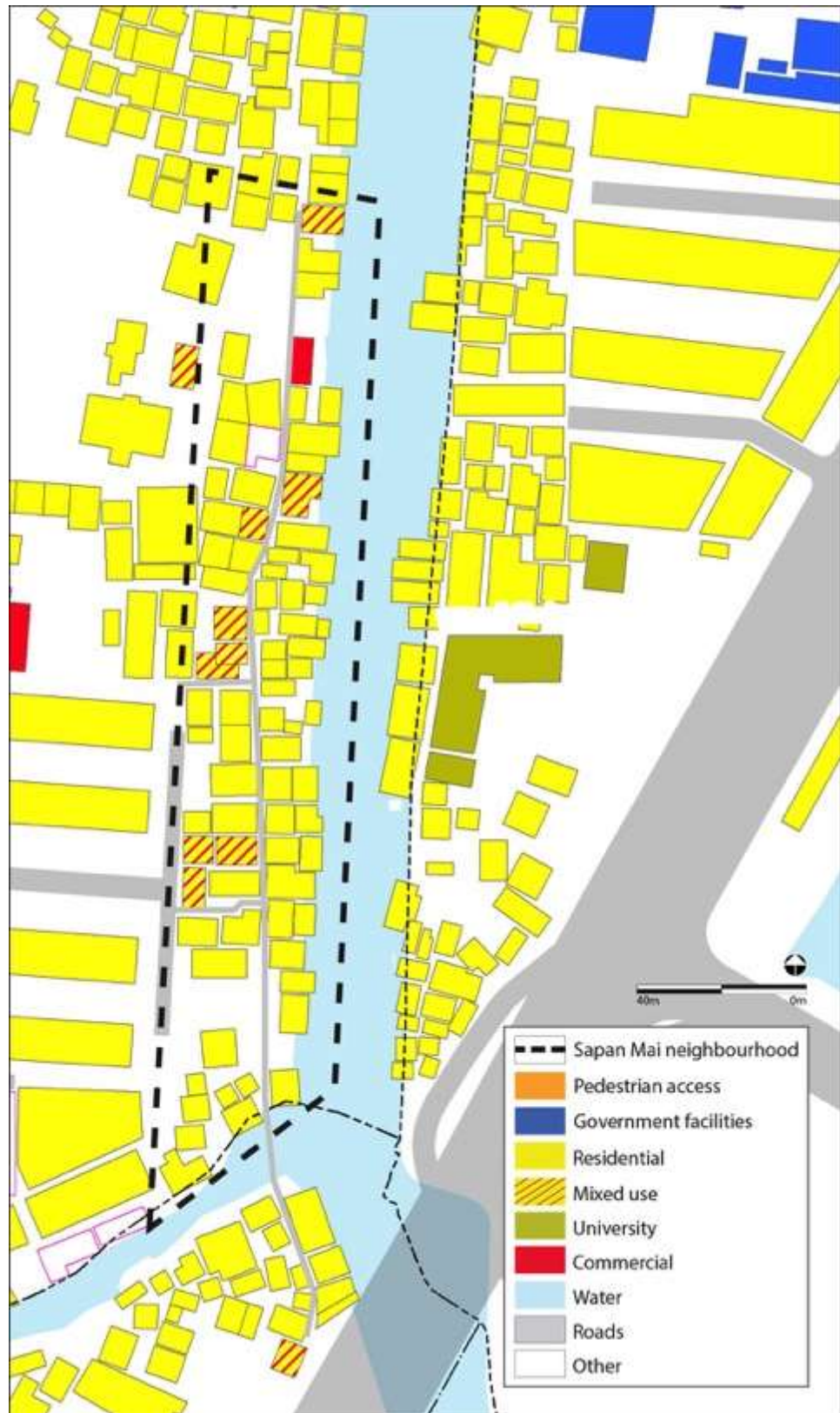


Figure 8.3.1e: The main pedestrian lane runs through the centre of the neighbourhood, and is illustrated in gray. Although the map shows building use as recorded by the municipal government in 2009, the larger roads remain relatively unchanged. A more updated map was not available. (Department of City Planning, 2014d)

8.3.2 Public open spaces

There is only one public open space in Saphan Mai, and it was not used during the flood because it was submerged. Instead, many of the distributions and flood related activities were arranged from the leader's house at the centre of the neighbourhood (SM14, middle-aged woman; SM1, middle-aged woman; SM11, elderly woman).

Some residents believed the use of the leader's home for neighbourhood activities suggested corruption (SM11, elderly woman) while others who were more supportive of the leader felt it was an appropriate use of space (SM14, middle-aged woman; SM1, middle-aged woman).

However, since before and after the flood, public open spaces were key spaces for people to earn money, make political decisions and to socialise in. The public open space is located at the centre of the neighbourhood, and is a place that was designed for children to play in, much like the space in Bang Bua Neighbourhood.

The new space offers children safety and protection away from the apartment parking lot where they normally play. However, children do not use the open space and continue to play in the parking lot for reasons unknown to the adults interviewed. Instead, the space more frequently hosts neighbourhood meetings by the savings group or more general neighbourhood meetings such as the one picture below in Figure 8.3.2a.



Figure 8.3.2a: A photo of public space located at the centre of Saphan Mai is used for a meeting between residents regarding a funding proposal to the district authority for development activities. Source: the author

Having discussed the influence of economic, governance and social CAS on movement networks and public open spaces, several key dimensions of resilience stand out. Firstly, from a governance perspective, the neighbourhood was made safer after it invested in new pedestrian lanes that made the neighbourhood more permeable, accommodating economic and social activity.

Secondly, the central location of the public open spaces created space for hosting social and governance activities. This chapter will now present analysis of the key influences on the plots layer.

8.4 Plots

Saphan Mai has been a legal cooperative renting land from the National Treasury Department since 2009, which has been the largest incentive to invest in the overall improvement of the neighbourhood and its plots. Before the flood struck 61 houses had gone through the reconstruction process. After the flood, an increase in trust in the governance system and growth in social capital influenced newcomers to join Baan Mankong (SM10, an elderly woman; SM14, a middle-aged woman).

Today, all residents of Saphan Mai lease four Rai of land (1.6 acres / 6,400 square meters) for 32,040 Baht (GBP 592) per year (SM9, an elderly man involved in leadership). Each household pays 18 Baht (GBP 0.33) per month, regardless of the size of their plot of land.

The plot structure of Saphan Mai rapidly changed when the upgrading was set in motion in 2009. Some of the houses moved from the canal to the landside, and some did not. The map in Figure 8.4a below shows the neighbourhood before upgrading occurred. It identifies registered houses in brown and non-registered houses in orange. It also shows houses encroaching on the canal.

After the flood 45 houses joined the upgrading process. As of 2014 the municipal government recorded building use as seen in Figure 8.4b however (which follows Figure 8.4a) many of the houses have since moved from the canal and re-organised on the landside.



Figure 8.4a: A map of Saphan Mai before the upgrading process began. Source: (Saphan Mai, 2004)

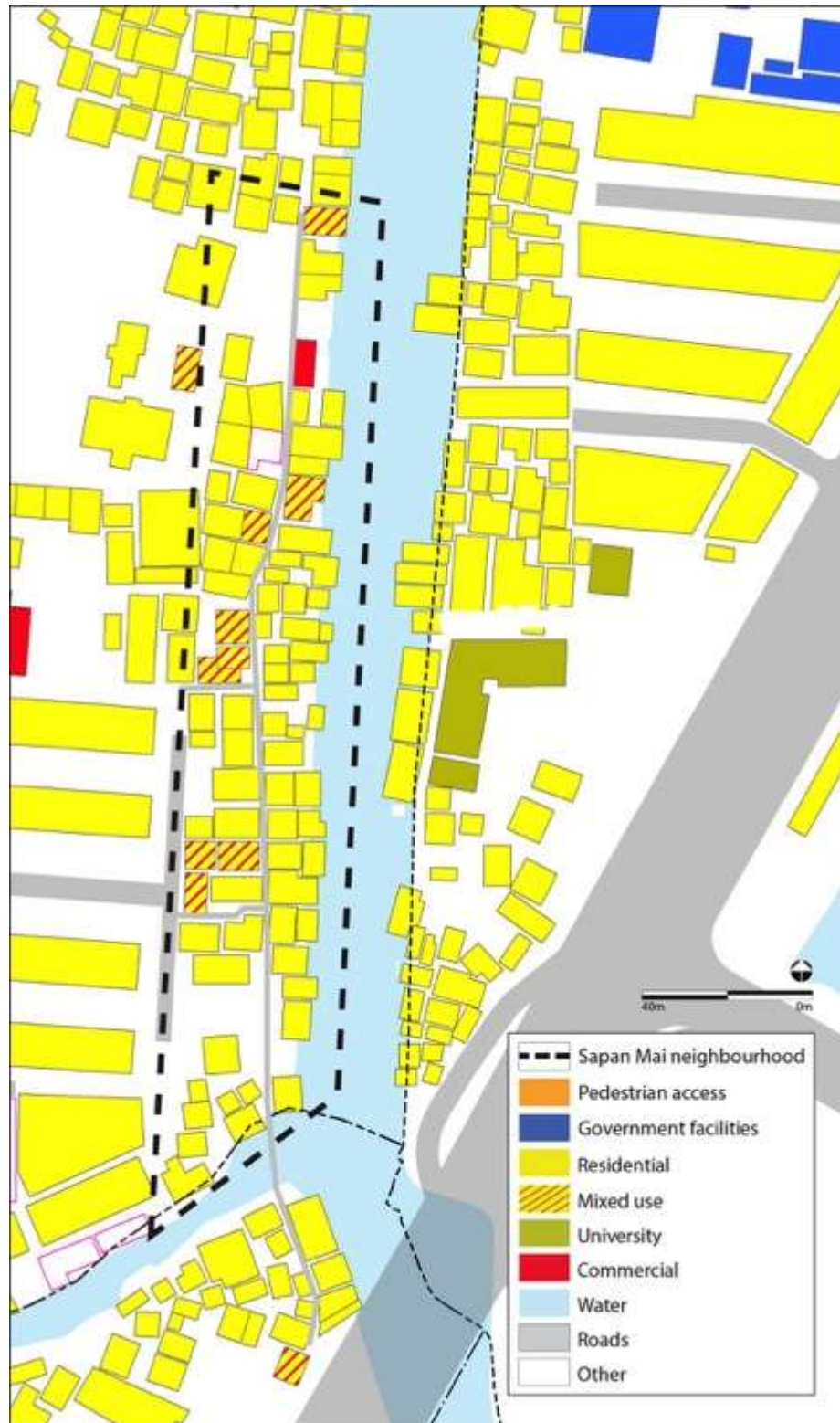


Figure 8.4b: building use as recorded by the municipal government in 2009¹. This map depicts more houses on the canal than are actually present. However, a newer map reflecting the current position of all the houses was not available.

While development of the built environment has largely been achieved in Saphan Mai, it appears that the social fabric has been negatively affected in some places by the process. The neighbourhood is divided into two groups, and one of the consequences has been a decreased capacity for cooperation between the two. The conflict began with the introduction of Baan Mankong. There are three reasons why people did not want to join the programme. Firstly, some people were already happy with the condition of their homes. One person interviewed said knocking her home down would undo years of investment and improvement (SM10, an elderly woman). Secondly, some people did not trust the leader because a majority of the neighborhood is related to him, and supports his decisions automatically.

Thirdly, others did not trust the Baan Mankong programme and the kind of debt it built; some people had migrated to the canal specifically because they did not have to pay for land or rent. Conflict also arose over how to treat renters, although people who had been renting in the area for longer than five years had the right to eventually own property (SM9, an elderly man on the leadership committee; SM19, a young woman). A local development worker from the area summarised the conflict as between a 'feudalist leader and those that don't want Baan Mankong because they do not have the money to rebuild their homes' (KI14, 2014, a local aid worker). Approximately 17 families (16 per cent of the neighbourhood) did not want to move ahead with the upgrading plans (SM9, KI14).

8.4.1 Savings structures

According to a local development worker (KI14), Saphan Mai was one of the last neighbourhoods along the canal to set up a savings group due to internal conflict and fear of debt. The savings group visited other neighbourhoods in the network to learn good practice before the group became active in 2009 (SM9, an elderly man; KI14, a aid worker). There

are now 159 people in the savings group (SM9, an elderly man). The group is governed by a committee of 11 people, half of who must be present in order for a meeting to run. Loan requests must be submitted before the 20th of every month; the committee meets to discuss the requests on the 25th. When asked about the transparency of application approvals one person said, 'In this community everyone knows each other and who needs help in what way' (SM16, 2014, a middle-aged woman). It appears there could be a better system for approving loans, such as establishing clear criteria and publicly announcing successful applicants in the interest of accountability.

During the flood, the economic savings structures that were set up became a crucial element of survival. The neighbourhood savings group purchased food and water and set up a neighbourhood kitchen. Volunteers offered to cook, and residents from Saphan Mai and its surrounding areas accessed the kitchen (SM9, an elderly man). A government party also set up a food kitchen on a highway bridge near to Saphan Mai (SM22, an elderly man).

Residents stressed that access to loans after the flood was key to restarting their jobs. One key informant from the leadership committee said 30-40 people borrowed money from the savings group at a reduced rate of five per cent instead of eight. The same person estimated that approximately 20 per cent of people seeking loans used a 'Muslim loan shark' that offered a rate of 20 per cent interest and that the others used a motorcycle mafia group offering loans at 24 per cent with a history of violence in response to unpaid loans (SM9, an elderly man). People who did not get access to government grants for home repairs were especially financially vulnerable, requiring money to fix their homes, pay school fees and restart their livelihoods.

While 45 homes were upgraded after the floods, residents did not report the start up of new livelihood groups like those formed in Bang Bua Neighbourhood during reconstruction. Income earning potential did not appear to increase with the re-blocking of plots and the reconstruction of houses as paid labourers did most of the reconstruction. In comparison to Bang Bua Neighbourhood, Saphan Mai residents have not taken the same opportunity to upgrade individual skill sets or form groups in the interest of better economic earning power. A large number of people continue to have a limited ability to meet basic needs due to low paying jobs (SM12, a middle-aged woman; SM11, an elderly woman).

8.4.2 Governance structure

Neighbourhood governance structures set up during the upgrading guided the flood response and the way in which resources were shared amongst residents. For the most part, residents felt the resources were shared equitably, and that the systems for sharing instilled newfound trust, so much so that one woman said that after witnessing the selflessness of the leadership she joined Baan Mankong because she trusted the leader (SM6, a young woman). Most residents interviewed stated that donations were announced on a public loud speaker before they took place. When the location changed, many said notifications were made. However, a small minority of people who were displeased with the leadership before the flood said they were unhappy with the way the donations were handled (SM10, elderly woman; SM11, elderly woman; SM12, middle-aged woman). The women reported that the neighbourhood leadership announced distributions late at night, requiring people to wade in deep water in the dark, giving an unfair advantage to people unable or unwilling to do so until daylight.

Much can be said about the governance structures contributing towards the capacity for conflict in Saphan Mai. To begin with one family holds

some of the most crucial leadership roles within the governance structure. While the elected committee and the Baan Mankong committee are two entirely different structures, the same people are involved in strategic leadership positions in both. The leader of the Baan Mankong upgrading programme is married to the elected leader. Both were the first to take on their respective positions and are still the leaders today. In addition, the accountant for both committees is the daughter of the married leaders. The disenfranchised group of people in Saphan Mai say it is relatives and friends that keep the current team in power, and that the group of people who do not hold the same opinions as the leadership has been silenced (SM5, a young woman; SM10, an elderly woman; SM22, an elderly man; SM36, a young man). One development worker from the area confirmed that power rests with the Baan Mankong leader who grew up in Saphan Mai and ‘therefore has more connections, power and votes from relatives’ (K114, 2014). Figure 8.4.2a presents a diagram that represents the governance structure in Saphan Mai that creates conflicts of interest.

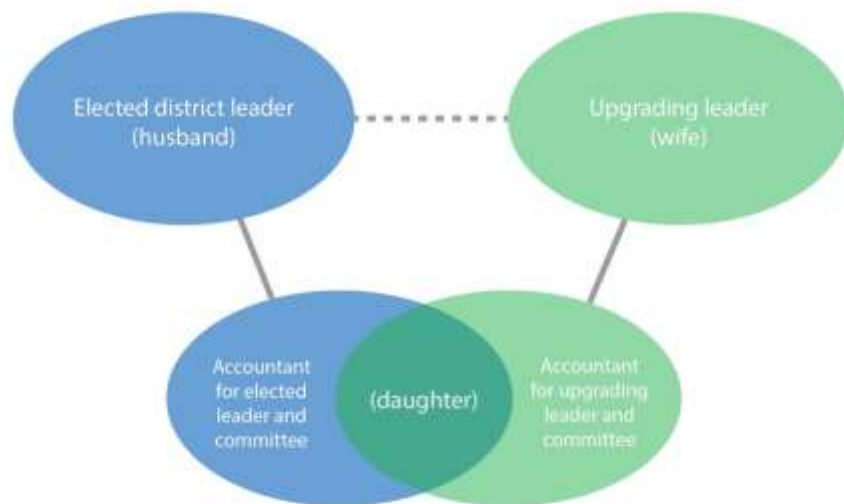


Figure 8.4.2a: A diagrammatic representation of the overlaps between a husband, wife and daughter who hold key leadership positions in Saphan Mai. Source: the author

According to one local aid worker key informant, the previous governance structure was uprooted when the Baan Mankong programme started (KI14). When asked about the history of the power dynamics in Saphan Mai, the aid worker said, 'Before Baan Mankong there was another organisation doing work there [Saphan Mai]. Then Baan Mankong came and set up a new structure with a new person in power' (KI14, 2014).

8.4.3 Fluidity of social tensions

The disaster became an opportunity for two disparate groups to work together towards a single cause: survival. One middle-aged woman spoke about how people became more 'connected' and had the chance to get to know each other because they were all in the same dire situation (SM1, a middle-aged woman). A spirit of volunteerism and sharing was essential to well-being as expressed by one middle-aged woman who had been against the upgrading process for years and changed her mind after the flood.

She said, 'Flooding taught me so many things. Money didn't help me get food or friends, but friends shared their food, sadness and happiness. Living with other people during the flood made me realise I could share and sacrifice things like the area around my house' (SM6, 2014). People who could not cope with the flood at home moved to evacuation centres at a nearby temple and to Don Meuang airport, among other places. Families in extreme poverty said they relied upon loans from friends and employers as well as food donations from the nearby temple in crisis and non-crisis times (SM12, an middle-aged woman).

Before and after the flood, social divisions were apparent from a spatial perspective. Those closest to the open spaces at the centre of the neighbourhood are supporters of the current leadership. The houses at the back of the community bordering Saphan Mai II, a different

neighbourhood, are home to families in opposition of the current leadership. Disenfranchised by the upgrading process, one long-term resident of Saphan Mai claimed that while the physical façade of the neighbourhood has improved, key relationships remain broken, a root cause of much of the social tension. The middle-aged woman said, 'some of the houses changed after the flood. People had to rebuild parts of their houses; sometimes their whole house, but the same old issues and personalities remain. Some people do not have very giving hearts' (SM16, 2014). In summary, the 17 houses that opposed Baan Mankong were faced with an ultimatum: to leave if they could not afford to participate or begin to trust the process if they wanted to stay. One elderly man from the leadership committee said, 'in a way the co-operative forced people to join: the cooperative sued people who don't join because they were trespassing. We threatened with action but in the end didn't do it because we were able to settle through mediation' (SM9, 2014).

Therefore, after the flood, everyone in Saphan Mai began working together through participation in a savings group and a cooperative. However, conflict between Baan Mankong and non-Baan Mankong supporters remains. After the flood, it appears that social capital and trust increased for the 80 per cent who support the current leadership while approximately 20 per cent languishes in complaints about corruption and transparency, particularly during the flood.

The plots layer explained the ways in which economic, governance and social CAS influenced changes in the built and natural environment at the scale of the plot. Based on the discussion it can be concluded that there are four key dimensions of resilience. The first is the presence of Saphan Mai's secure land tenure, which has created stable conditions for individuals to invest in neighbourhood infrastructure and systems.

The second is Saphan Mai's moderately effective savings group, which struggled with transparency and accountability for many years before it became functional. The third driver is Saphan Mai's moderately effective governance mechanism, which is built upon conflict of interests.

The fourth is Saphan Mai's limited ability to self-organise due to social tensions arising between the upgrading group and the opposition to it. The next layer will present analysis of the ways in which CAS transformed buildings and services in Saphan Mai.

8.5 Buildings and services

The flood interrupted existing tensions and processes within the neighbourhood. Ultimately, homes that did not participate in the upgrading process were most affected by the flood, demonstrating the long-term economic tradeoffs of upgrading physical infrastructure with the shorter-term financial burden of reconstruction.

8.5.1 Strong homes versus vulnerable homes

The homes most vulnerable to the impact of the flood were built of inexpensive, locally available materials that are climatically responsive to hot weather. Many such houses are built on wooden stilts on the canal. When the flood occurred, the stilts holding up the houses sunk and the wooden floorboards, walls and doors were water logged and rotted after being immersed in floodwater for three months.

Canal-based houses were most often single storey, reducing the space for storing valuables out of the reach of the floodwater. Figure 8.5.1a shows an example of a vulnerable single storey wooden home built on stilts in Saphan Mai.



Figure 8.5.1a: A single storey wooden home built on stilts in Saphan Mai neighbourhood. This type of housing is vulnerable to flooding. Source: the author

Homes less vulnerable to flooding were constructed from a mix of concrete, wood and brick with two stories as shown in Figure 8.5.1b. Before the flood struck, 65 such homes were built.

The new houses typically have shingled roofs. Many of the houses in Saphan Mai do not have outdoor terraces due to space restrictions; those that do have noticeably smaller ones (Figure 8.5.1b).

Many of the homes have worship shrines connected to them. The reconstruction of all the houses in the neighbourhood began in 2009 and by 2014 construction of the last seven homes was underway.



Figure 8.5.1b: Homes less vulnerable to the floods were the ones that were constructed from a mix of concrete, wood and brick as shown in the photo of a house frame on the left. Less vulnerable homes have two stories as shown in the photo on the right. Source: the author

After the flood 45 houses were reconstructed. Some of the residents chose to participate in the upgrading because they saw the long-term economic gains of investing in a robust home (SM14, a middle-aged woman; SM16, a middle-aged woman; SM20, a young woman). For others, the ultimatum from the cooperative forced them to invest if they wanted to stay in Saphan Mai (SM9, an elderly man).

The smallest house offered by the Baan Mankong programme is 3 x 7 meters; the largest is a duplex of 3.5 x 9 meters, which is often co-owned. Loans over 300,000 Baht (GBP 5547) per house are not granted by CODI. Table 8.5.1a shows the yearly and daily cost of a loan in relation to the size of a house in Saphan Mai.

Size	Cost in Baht	Total Cost GBP	Yearly Cost	Daily Cost
3 x 7	162, 171 Baht	£2,999.00	£200.00	£0.55
3 x 9	186,763 Baht	£3,454.00	£230.00	£0.63
3.5 x 9	400,262 Baht	£7,401.00	£493.00	£1.35

Table 8.5.1a: Housing sizes and costs in Saphan Mai. Loans are calculated to a 15-year period. Source: the author

8.5.2 Access to services

During the flood, houses with two storeys had access to a basic level of electricity and running water. However, most houses were unable to use their toilets. Four portable toilets were donated by BMA, but were not used much because no one was responsible for cleaning them (SM 22, an elderly man).

Black bags were used to store human waste and then thrown into the canal because waste removal services halted for three months. Drinking water was donated or purchased from the store. Some of the smaller shops nearby ran out of supplies. Larger grocery stores still carried bottled water but the journey there was often difficult, expensive and time consuming (SM2, a middle-aged woman).

However, access to services such as electricity and water was not an issue before the flood or after. Running water came to Saphan Mai in 2002 after an arrangement was made with politicians who promised the service would be provided to the area if they won office (SM9, an elderly man). Before that time people used water from the canal or purchased it (SM9, an elderly man). Today, drinking water is purchased, either from stores or from a vending machine located at the centre of the neighbourhood. Wealthier individuals own their own washing machines, refrigerators and air conditioners.

According to a member of the leadership committee, Saphan Mai has had access to electricity since 1974 (SM9, an elderly male). Due to the fact that all the homes in the neighbourhood are now registered, they therefore have the legal right to access water and electricity. Each house is equipped with its own meter. Sewerage tanks (as shown in Figure 8.5.2a) have been installed in the new homes, regulating sanitation practices and therefore reducing the amount of pollution entering the canal. The district

government collects rubbish from communal bins on a weekly basis. Figure 8.5.2b shows the rubbish collection point next to the tent in the public open space at the centre of the neighbourhood.



Figure 8.5.2a: Sewerage tanks pictured in front of the community building are fitted into the newly reconstructed homes. Source: the author



Figure 8.5.2b: A rubbish collection point next to the tent at the centre of the neighbourhood. Source: the author

8.5.3 Access to community centres

There are two community centres in Saphan Mai. Neither was used during the flood as a central hub for response activities, perhaps because they were not possible to reach by vehicle. The way in which the first community centre was used after the flood further reflects the social divisions within the neighbourhood.

The community centre is indeed used for community activities, but by a selective group of people who manage the administrative side of the upgrading and neighbourhood development work, making the usage of the building seem exclusive. The building is dual purpose. Saphan Mai residents refer to it as 'the office', however the neighbourhood received donations of 100,000 Baht (GBP 1,849) from World Vision Thailand, a national NGO, to build a health centre (KI17, a local aid worker). The district government contributed 150,000 Baht (GBP 2,774) to build a community centre (KI34, a person in a neighbourhood leadership role).

The two-storey concrete building has a chain link fence around its perimeter and a locked gate. Inside it hosts three desks, two computers and paperwork related the upgrading. The upstairs area of the building is used to store goods because it is too hot to use as a workspace during the day without air conditioning, which is not installed.

At the time of research an elderly woman was living on the top floor for several months while she awaited the completion of her new home. The courtyard inside the compound is approximately three meters by four meters and at the time of research was storing equipment for the reconstruction of the seven remaining homes.



Figure 8.5.3a: A two-storey community building where administrative work takes place. Source: the author

The second community centre (shown in Figure 8.5.3b) is a tented area situated next to the open public space where meetings are held. The tent was donated by World Vision Thailand, and provides a respite from the sun. However, a member of the leader's extended family, for personal economic gain, appears to have appropriated the space by setting up a permanent food stand with two tables to serve customers as shown in Figure 8.5.3c. A chain and lock is used to close the space when the food stand owner is not present. Motorised toys belonging to the leader's toddler grandchild are also stored in the area when it is locked up. When different key informants were asked what the intended use of the tent space was, several different answers were given.

A key informant from an NGO working in the area said (KI17) said the space was for neighbourhood gatherings and activities; a relative of the leader's family (SM8, elderly woman) said the was space for households to park their motorcycles (although no evidence of this was observed by the researcher); others said the space was claimed by a relative of the leader who set up a food stall to earn money (SM6, a young woman; SM10, an

elderly woman; SM11, an elderly woman; SM16, a middle-aged woman). The misappropriation of space has created a sense of mistrust and suspicion for some residents unrelated to the leader, and is part of the reason some residents delayed their participation in the Baan Mankong upgrading.



Figure 8.5.3b: A view of the World Vision Thailand tent intended to be used as a community building but is instead host to a food stall for personal economic gain. Source: the author



Figure 8.5.3c: Saphan Mai residents frequent the food stall that is set up in an area designed as a community building. Source: the author

Having explained the influence of economic, governance and social CAS in the building and services layer, several key dimensions of resilience can be identified. Firstly, only some of the housing was flood resistant. Many people evacuated their homes in order to find adequate shelter and access to services during the flood. Secondly, the community building use was not equitable with exclusive access given to office space for neighbourhood committee personnel.

The people in power limited economic opportunities arising from building use to those who were relatives or friends. Thirdly, the inequitable use of space created tensions within the neighbourhood limiting growth of social capital. The next section will explain how the dimensions of resilience identified at different layers were validated.

8.6 Validating findings

The dimensions that were identified at the different morphological layers of Saphan Mai were validated with eight neighbourhood residents in a focus group discussion.

The discussion assisted to clarify which of the dimensions within the CAS were the most influential before, during and after the flood in Saphan Mai. A statement about the dimensions was read out loud, and residents were asked to agree or disagree with the statement and provide reasons for their perceptions. The discussion validated the dimensions and higher level concepts under discussion. Key conclusions regarding resilience in Saphan Mai will be presented next in the conclusions section below.

Conclusion

This chapter aimed to identify dimensions of resilience at different morphological layers based upon patterns of influence formed by CAS within each layer. Analysis was conducted before, during and after the flood struck Saphan Mai in order to account for the specific details within the complex inter-dependent and overlapping relationships between systems and morphology.

To begin with the chapter gave a neighbourhood profile of Saphan Mai. It then explained that topographical information about Saphan Mai was already explained in Chapters Five and Six and was therefore not included in this analysis to avoid duplication. The chapter then presented analysis of the movement networks and public open spaces layer; the plots layer; and the buildings and services layer. A synthesis of the original analysis and the feedback from the validation process can be summarised in four key points.

Firstly, the flood interrupted existing tensions and upgrading processes in Saphan Mai, offering an opportunity to test economic and governance structures with a development focus in a time of crisis. Overall, these mechanisms worked well. The savings group was essential during the flood by setting up a food kitchen and after the flood by providing access to loans with lower rates due to the crisis. The governance mechanisms were also adapted to meet crisis needs. Most people in Saphan Mai felt donations were shared equitably and succeeded in building trust.

Secondly, while the built environment has become physically less vulnerable with the incremental upgrading, tears in the social fabric prevent the entire neighbourhood from developing to its fullest capacity. When the cooperative gave the opposing households an ultimatum to participate or leave they set up a structure for reluctant participation to

occur. People who oppose the upgrading or dislike the leader are unlikely to participate in neighbourhood scale activities.

Thirdly, the use of public open spaces and community buildings explains the monopoly of power the leadership committee has on the neighbourhood. The governance structures also support this finding due to the conflict of interests of a husband, wife and daughter holding key positions of power.

Fourthly, the most vulnerable homes were the ones that were not upgraded. The legitimate right to occupy the land meant households were more willing to invest in high quality infrastructure that improves the overall livability and well-being of the neighbourhood by adding public open spaces, community buildings and stronger homes.

Chapter nine

Case study three – analysis of Roi Krong neighbourhood

Introduction

This chapter analyses the specific ways in which economic, governance and social CAS influence four different morphological layers in order to establish dimensions of resilience before, during and after the flood in Roi Krong Neighbourhood.

To do this, the chapter begins with a neighbourhood profile of Roi Krong, giving background to the neighbourhood. It then moves to the topography layer, reminding the reader that topographical analysis was conducted in Chapters Five (everyday risks) and Six (the impact of the 2011 flood). It then discusses the movement networks and public open spaces layer, explaining the economic and social opportunities that roads and open spaces created and the dimensions of resilience that can be observed. Interrogation at the plots layer explains the dimensions of resilience seen

in the relationships between economic, governance and social systems. Meanwhile, the buildings and services layer explains building usage and access to services, highlighting how conflict over Baan Mankong has shaped the buildings in the neighborhood. Finally, this chapter explains how the key findings were tested with residents of Roi Krong to validate the key dimensions of resilience identified in each layer.

Methodological approach of this chapter

This chapter uses the same methodological approach for analysis as was used in Bang Bua Neighbourhood and Saphan Mai. The methodological approach in Roi Krong Neighbourhood consisted of two methods: morphological analysis and coding (through the use of NVivo software). Maps with information about building use were the primary morphological tools used for Roi Krong. NVivo software was used to code analysis from key informant interviews and focus group discussions. Further information for coding was gathered through participant observation, key informant interviews and transect walks. Journal writing was used as a method for documenting observations and drawing connections between key themes.

9.1 Neighbourhood profile

Roi Krong is a Neighbourhood that developed under an eight lane highway and bridge; the neighbourhood runs adjacent to the highway, parallel to the canal. According to the elected leader, Roi Krong has 135 houses (125 registered and 10 unregistered) living on eight Rai (1.28 hectares or 3.2 acres) of land. It is 150 meters long and 25 meters wide, double the size of Saphan Mai with only 20 more households. In 1986 the neighbourhood was formally registered with the Bang Khen district government, according to the leader of the Baan Mankong programme who has been living in the area for almost 60 years. A total of 28 households were interviewed, equating to approximately 22 per cent of the neighbourhood. Based on

direct observation of the houses and assets inside the homes, Roi Krong has more affluent families than Bang Bua and Saphan Mai. The elected leader estimates that approximately 50 per cent of the residents are daily wage earners working as vendors or labourers; 30 per cent work in office jobs and 10 per cent in governmental positions. Roi Krong is a neighborhood divided between those who participate in the Baan Mankong upgrading scheme (approximately 40 per cent) and those who oppose it (approximately 60 per cent).

Figure 9.1a below is a photograph of Roi Krong. Low quality homes on the canal block the view of more affluent homes built on the landside of the neighbourhood. Figure 9.1b is a building use map that shows Roi Krong's location along the canal perpendicular to the main highway.



Figure 9.1.a: Roi Krong neighbourhood (left). Low quality homes on the canal block the view of more affluent homes built on the landside of the neighbourhood. Source: the author

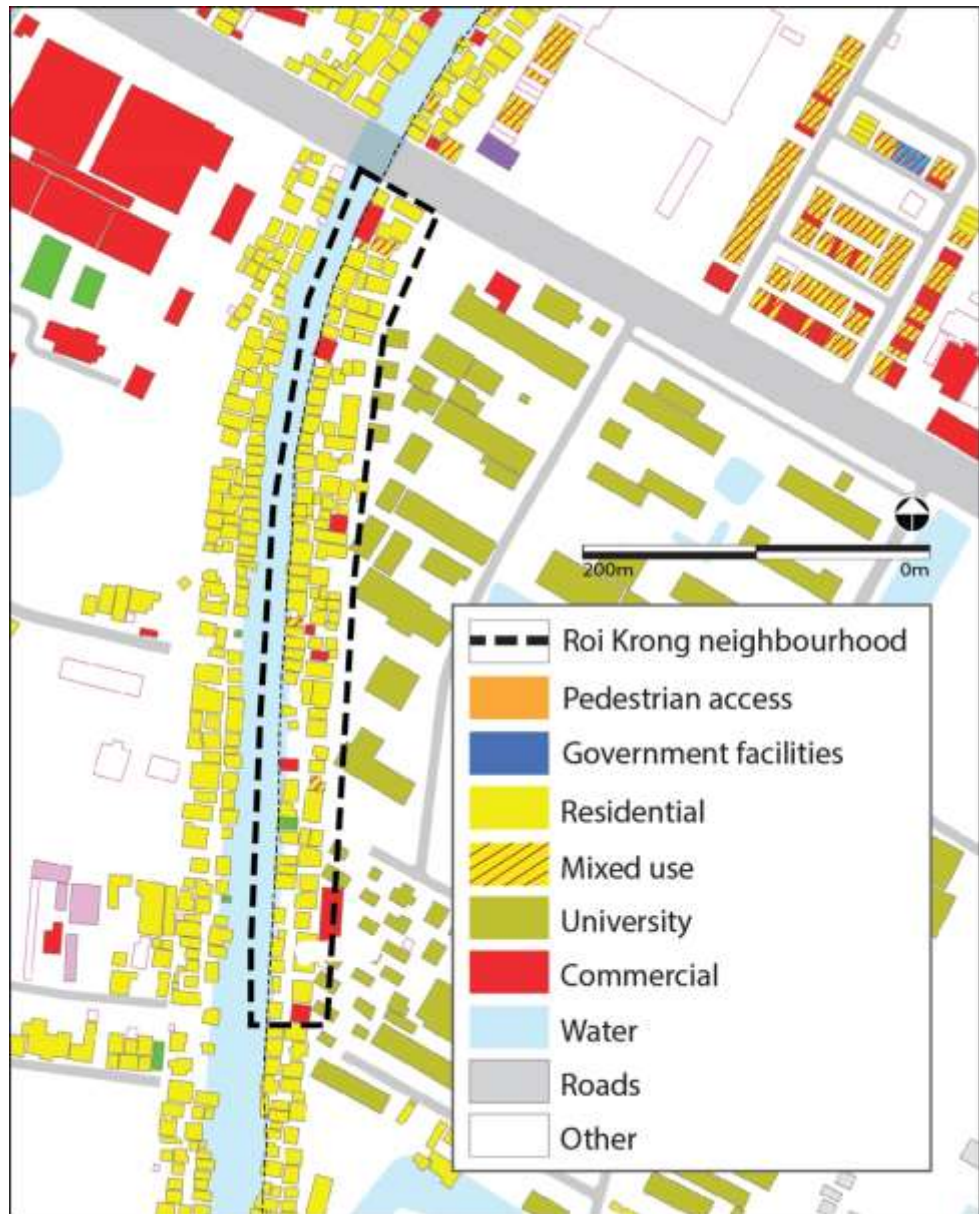


Figure 9.1b: A building use map that shows Roi Krong’s location along the canal perpendicular to the main highway. Source: (Department of City Planning, 2014d)

When the 2011 flood occurred, the floodwaters came at a gradual and steady pace. The leader of Baan Mankong had joined the Bang Bua Canal Network trip to the north to learn about flood preparedness and response. In a separate event, the elected leader in Roi Krong also volunteered in the north for flood response activities through his political affiliation. News of the flood came by word of mouth as well as from the TV and radio because Roi Krong’s public announcement speaker was not working.

Advice was given to prepare by stocking up on food and water, which was a challenge for people living day to day and could not afford to stock items. More people evacuated from Roi Krong than in the other two case studies. However, like the other two case studies, food, sanitation and unemployment were three of the biggest challenges during the flood.

Having described Roi Krong's neighbourhood profile and key aspects of the flood, an explanation of the topography layer will be provided next.

9.2 Topography

As stated in case one and case two, analysis of the topography layer was conducted in Chapters Five (covering everyday risk) and Six (covering the impact of the flood), and therefore will not be included in this chapter. Next, an explanation of the transformation of movement networks and public open spaces in Roi Krong is provided.

9.3 Movement networks and public open spaces

All of the lanes and public spaces in Roi Krong flooded. People primarily used boats to get around, and as a last resort waded through the water by foot using the neighborhood lane network. The state of the lanes and public spaces before the flood offers insights into a neighborhood conflict over Baan Mankong's upgrading, which is much more entrenched than the one in Saphan Mai. Changes in the use of public open space suggest that since the flood each side has become further intent upon not engaging with the other.

9.3.1 Movement networks

Roi Krong has one narrow pedestrian lane that runs through the centre of it as shown in Figure 9.3.1a. The lane is wide enough to accommodate a small motorcycle. Several smaller alleys have been created in one pocket of the neighbourhood where re-blocking has occurred. Those who

participate in the upgrading programme would like to see a pedestrian lane built on the canal bank as has been done in Bang Bua Neighbourhood and is currently being undertaken in Saphan Mai, however houses on the canal prevent such infrastructure from being built. There are three entrances to Roi Krong as shown in in a map in Figure 9.3.1b. The first is from Chaeng Watthana highway, the second via a bridge in the middle of the canal, and a third from the Rajabhat university campus. There has been very little change in the road system since it first came into existence. An eight lane highway that narrows into a four lane bridge is the entrance of Roi Krong (see Figures 9.3.1c and 9.3.1d) .



Figure 9.3.1a: Roi Krong has one narrow pedestrian lane that runs through the centre of it as shown in the photo above. Source: the author

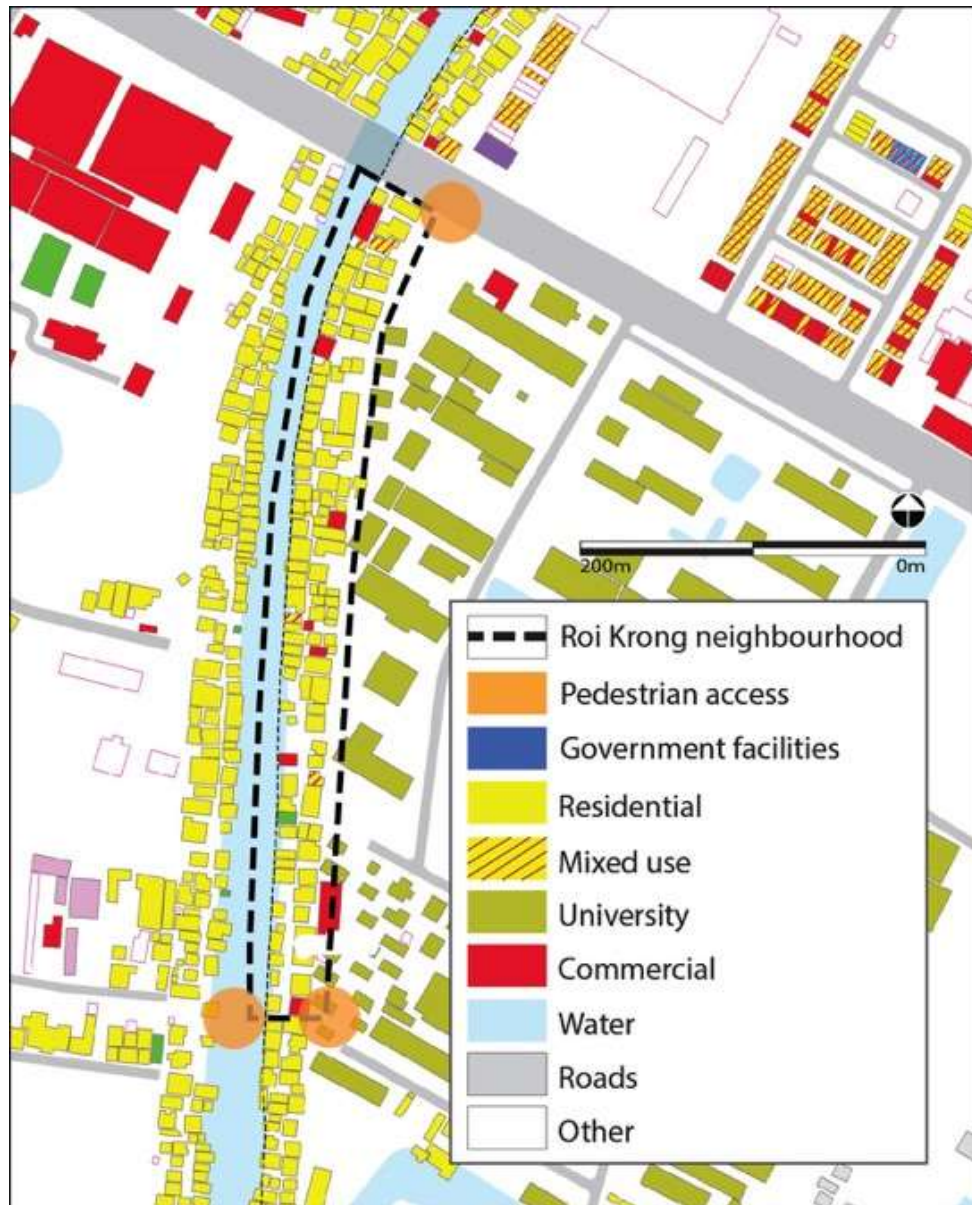


Figure 9.3.1b: There are three pedestrian entrances to Roi Krong as shown in the building use map of Roi Krong above. Source: (Department of City Planning, 2014d)



Figure 9.3.1c: An eight-lane highway is the primary entrance to Roi Krong. Source: the author



Figure 9.3.1d: Access to Roi Krong is gained through a narrow lane that runs parallel to the bridge incline. Source: the author

9.3.2 Public open spaces

Under the bridge incline there is a pocket of open space used for socialising and income generation. Stands selling vegetables, shoes and other merchandise experience heavy footfall due to residential homes to the left and right of the bridge (see Figures 9.3.2a and 9.3.2b). Directly underneath the bridge is a space where people gather to drink alcohol and play cards (Figure 9.3.2c). However, safety and security became a concern when the narrowest point of the bridge incline began to host drug users and homeless people seeking shelter for the night (RK13, an elderly woman). The Bang Khen district government has put up a mesh wire fence to prevent people from occupying the space under the bridge incline (see Figure 9.3.2d).



Figure 9.3.2a: A view to the left of the bridge of the fruits and vegetables stands that are hosted in the open public space within the movement network in Roi Krong. Source: the author



Figure 9.3.2b: A view to the right of the bridge of the fruits and vegetables stands that are hosted in the open public space within the movement network in Roi Krong. Source: the author



Figure 9.3.2c: The space under the narrow incline of the bridge is used for storing goods and socialising in Roi Krong. Source: the author



Figure 9.3.2d: A mesh wire fence has been put up to prevent homeless people and drug users from accessing the public open space in Roi Krong. Source: the author

Having explained the use of movement networks and public open spaces in Roi Krong several dimensions of resilience can be identified. Firstly, a road network with narrow pedestrian lanes that do not permeate the neighbourhood contributes to a lack of safety. Secondly, narrow lanes limit space for socialising and economic activity. Furthermore, the presence of public open space presents opportunities for small-scale businesses and social gatherings to take place. The fourth dimension identified is that the quality of the public open spaces influences the level of safety within those spaces driven by the types of activities carried out – such as drug use and drinking. This chapter will now present analysis of the dimensions of resilience within the plots layer.

9.4 Plots

Roi Krong spans an estimated 25 meters from the canal to the property line it shares with Rajabhat University. Within that space exists two rows of houses and a pedestrian lane. Generally speaking, the plot arrangements in Roi Krong achieve more privacy than Bang Bua

Neighbourhood and Saphan Mai due to taller fences made of concrete or closely slated wood, providing maximum privacy. Plots that cannot afford such expensive boundary indicators have used corrugated iron, bamboo sticks or rope to outline private property as shown in the photos in Figure 9.4a below. Behind the gates and fences, many homes have a terrace or a private outdoor open space. Those on the canal have a terrace facing the water and those on the land have built their terrace looking onto the pedestrian lane, facing the canal based homes.



Figure 9.4a: The blue cement fence (left) and the corrugated iron fence (right) are examples of the fences that surround outdoor living space in Roi Krong. Source: the author

Land tenure has not been secured in Roi Krong. Figure 9.4b below is a map that shows the current layout of the plots, indicating registered and unregistered houses. Residents have not been able to work through Baan Mankong or their own mechanisms to reach a consensus about renting the land. Conflict exists around the ways in which the land should be shared and redistributed. At the core of the land disputes are complex economic, governance and social dynamics, which are explained in this layer.



Figure 9.4b shows a map of the current layout of the plots, indicating registered (brown) and unregistered (orange) houses. Source: (Roi Krong Neighbourhood, nd)

9.4.1 Parallel governance systems

The flood highlighted two governance systems operating in parallel. Both structures sought to achieve the same goal of survival but chose different approaches. Within each system people reported that the flood gave them a chance to bond, build relationships and prove they could work together. For example, several people interviewed described sharing food, with people who belonged to either the elected leader and his supporters or to the Baan Mankong group. The Roi Krong's Baan Mankong group was highly dependent on the larger Bang Bua Canal Network for assisting with procuring food and non-food survival items. Their savings mechanism was not strong enough to support the neighbourhood on its own, and therefore they relied on the larger canal network's social safety net.

The flood gave the newest form of leadership – Baan Mankong – an opportunity to prove it was competent, efficient and trustworthy to the entire neighbourhood. One middle-aged woman from the upgrading group said, 'I had never experienced helping people in this way. We loved each other a lot during that time and helped one another. People who were quarrelling stopped their quarrels and put them aside during the flood. I think the flood created bonds, but we were very stressed when the water receded' (RK27, 2014). Through skills training and networking, Baan Mankong also empowered individual people who had had never held any formal leadership role to step into leadership positions. For example, the leader of Baan Mankong reflected that during the floods she, 'felt so proud, so appreciated. God damn it, no one knew me in the past or respected me! They thought I'm an uneducated woman but then saw all I was capable of. I went to the police office and got unemployed people food and supplies even after the floods were over. I took everything, no matter how little I was offered'.

Disagreement between the leaders about how survival items should be distributed was noted. The elected leader during the flood is different to the elected leader at present. Many people felt the flood exposed the previously elected leader as corrupt and voted in a new person (RK13, an elderly woman; RK14, an elderly woman; RK25, an elderly woman; RK27, an elderly woman; RK28, and middle-aged man). The current elected leader felt it was important to distribute supplies directly through neighbourhood leaders because they are familiar with the neighbourhood demographics and will ensure people do not get double. Meanwhile, the Baan Mankong leader felt sending donations through a network like Baan Mankong was better because it allowed the pooling of resources and contacts and the division of supplies when there is not enough for everyone.

9.4.2 Social obstacles within the savings group

Financial benefit from 'owning' land and buildings is the primary source of conflict in Roi Krong. While people do not own the land, they view themselves as owners or informal custodians. According to the elected leader, the social composition of the neighbourhood is such that approximately 30 per cent are renters; 30 per cent belong to a more affluent category and 40 per cent can be considered urban poor. While poorer people in the neighbourhood have mobilised to create a financial structure to help them better survive chronic stresses and shocks through Baan Mankong, approximately 60 per cent of the neighbourhood felt it would be financially harmed by the savings programme, which aimed to change ownership of plots and buildings. Therefore, the savings group was too small and undersubscribed to be an effective financial mechanism for renting the land before the flood and for providing a high level of financial security during the flood. As a consequence, both governance structures described passively awaiting donations more frequently than they would

have liked, unlike Bang Bua and Saphan Mai who were active in seeking and managing resources.

The heterogeneity of income levels in Roi Krong meant that using economic mechanisms as the primary method of engaging disparate groups did not work as an incentive for cooperation for the majority of the neighbourhood. Moreover, not unlike concerns aired by poorer urban people in case one and two, some of the most economically vulnerable believed they could not afford debt or were not comfortable with the idea of it. An additional obstacle to the success of the savings group is social vulnerability. For example, drug use is a widespread problem in the canal. One opponent of the upgrading (RK16, a middle-aged woman) said she moved to the neighbourhood because it was free to build her house, and worried that future generations would not be able to repay housing loans due to financial drains like drug addiction. She (RK16, 2014) said, 'Looking ahead, what if parents join with children who are hooked on drugs? How will the children pay off the loan if their parents die? It's better not to risk losing the house.'

Meanwhile, others perceived the upgrading governance structure as legally risky. Another middle-aged woman (RK15) who works as housecleaner expressed concern over being embroiled in a legal battle, an unacceptable risk for her. She said, 'There are 14 people in Bang Bua getting sued because they've defaulted on their loans. People here cannot afford to participate in Baan Mankong' (RK15, 2014). According to information shared by the Bang Bua leadership committee there are four people being sued, all of whom allegedly work in the drug trade. The concerns expressed above by people who are currently not participating in Baan Mankong reflect that economic and social vulnerability are factors that prevent the savings group from succeeding in Roi Krong.

9.4.3 Land conflict

While the flood improved intra-social relations within each group, conflict over land remains at the root of genuine change at a neighborhood scale. As one middle-aged woman observed, ‘after the (2004 Asian) tsunami, people helped entire communities to rebuild. It’s too bad that couldn’t happen here to really change things for the better. Instead, the floods left us with a mess and no money to clear it up’ (RK27, 2014).

Those who support Baan Mankong in Roi Krong tend to be people who are low-income earners, have poor quality houses, live on the canal and work as daily wage earners. This demographic is poised to gain the most through the upgrading programme: quality housing, reduced risk of flooding, and potentially new skills such as financial management and construction. One small block of houses has been able to negotiate space in order to carry out complete reconstruction of 25 houses (RK27, middle-aged woman). One middle-aged woman (RK16, a middle-aged woman) contends that success was based on a group of relatives working together to share a common space, indicating the social dynamics in this neighbourhood are strongest between relatives. For those who could not negotiate reconstruction, the second best option for building the physical resilience of their homes was to access loans to repair weak infrastructure (RK8, a middle aged man). A total of 12 houses used the loans to repair existing structures (RK27, middle-aged woman).

Meanwhile, according to residents from the neighbourhood, those who oppose the upgrading programme are often more affluent and tend to have more influence and power (RK17, a middle-aged woman; RK22, an elderly man; RK23, an elderly man; RK28, a middle-aged man; RK29, an elderly man; RK30, an elderly man; RK32, a middle-aged woman). More affluent people are described as working in office jobs for the government or as landlords within the neighbourhood. The most active opponents to

Baan Mankong appear to be on the elected committee, operating separately to the Baan Mankong committee. The elected committee members take regular social trips together (RK13, an elderly woman), affording them the opportunity to bond but further isolating the group from the Baan Mankong committee. Other active opponents to the upgrading are those who have invested in strong, robust homes over the years and do not want their investments to go to waste. One middle-age woman said that as the owner of an expensive home, she felt the potential loss of years of investment was unacceptable: 'If you join Baan Mankong you have to rebuild your house, but if you already have a good house, what's the point of going into debt and rebuilding it again?' (RK17).

A low level of trust amongst residents was also apparent when another middle-aged woman, who described herself as neither rich nor powerful, but ardent in her opposition to Baan Mankong, said she believes the programme is corrupt and does not negotiate with all parties involved in the process: 'The committee is not honest. People don't get real benefits. People don't cooperate with Baan Mankong because it tries to tell people where to live and where not to live' (RK11, 2014). Such comments suggest that improving the physical resilience of the neighbourhood is taking place at a social cost. Moreover, some feel that economic vulnerability should be prioritised over the physical vulnerability of houses. One such elderly woman observed that: 'people here need better jobs, need someone to teach them to make a living, how to pay loans' (RK13, 2014). The same elderly woman asserted that the neighbourhood needs 'community dialogue and to really understand what they are signing up for and if they can really afford it' (RK13, 2014). Analysis of activities at the plots layer points to a gap in communication, trust and a disagreement over prioritisation of development activities as potential reasons the Baan Mankong methodology is not working well in Roi Krong.

The analysis at the plots layer identified several dimensions of resilience based on the overlapping and interdependent CAS relationships and their influence on the layer. Firstly, while land tenure was not secured in Roi Krong, the security of tenure in neighbourhoods located up and downstream from Roi Krong seems to have reduced the risk of eviction for Roi Krong. Secondly, even though conflict exists in the neighbourhood, power is shared and parallel governance systems appear to operate in a healthy and democratic environment. Thirdly, economic and social factors have limited the success of the savings group through fear of participation. Fourthly, land conflict has reduced social capital and increased tensions between people in the neighbourhood.

9.5 Buildings and services

Homes in Roi Krong are built from a mixture of concrete and wood. The homes on the landside often have bigger plot sizes, are frequently made of concrete, and are generally larger than canal-based homes. Canal-based homes are built on stilts, have wooden or bamboo frames, floors and walls. The roofs are usually made of corrugated iron. If a portion of the canal based home is resting on solid ground, then residents will often use concrete to construct the floor. Pictures of the King decorate the inside of most of homes. It is common to see mosquito nets in poorer households and air conditioners in more affluent ones.

As was the case in Saphan Mai, the buildings most vulnerable to the flood were single storey wooden homes built on stilts over the canal. According to the leader of Roi Krong, approximately 40 per cent of the people in the neighborhood evacuated due to the poor quality of their homes. One poorer resident who stayed in an evacuation shelter for the duration of the flood said her family went there because there was food, a place to sleep and that 'life was better there'. Roi Krong residents said they employed a number of coping strategies such as reducing the amount and

quality of food they ate, as well as moving between their homes and evacuation shelters to pick up donations at both locations.

The departure of families to evacuation centres severely affected the rental market. One landlord reported offering free rent for one to two months to prevent the permanent loss of tenants (RK17, a middle-aged woman). Meanwhile, people who owned single storey wooden homes on the canal reported that their homes were severely damaged and the biggest challenge was finding enough money to carry out repairs. Unemployment during the three-month duration of the flood occurred for the majority of people in Roi Krong. Like in Bang Bua and Saphan Mai, daily wage earners required access to loans to restart their businesses before they could begin home repairs.

9.5.1 Rental property income

As suggested earlier, one of the reasons Baan Mankong is contested so widely in Roi Krong is because of the high levels of income generated through room rentals. The leader of the Baan Mankong group reported that the neighbourhood has the potential to rent between 97 to 177 rooms. Many of the rooms are located in large houses and dormitories abandoned by Rajabhat University 30 years ago, now taken over and managed by 'landlords'. The university built eight dormitories with 10-20 rooms on land owned by the government. Approximately 30 years ago it was asked to respect the property lines put in place by BMA, delineating public open space around the canal. In the process of withdrawal from government land the university did not demolish the original buildings and people took them over.

Today the market rate for a room rental is between 700-800 Baht (GBP 13-15) per month (RK17, a middle-aged woman). Making space for houses on the canal to move onto land would require property 'owners' to give up

significant amounts of income from room rentals. One dormitory owner of a 20-room building stated that the economic benefits of the current property motivated her to oppose neighborhood upgrading. While acknowledging the land does not legally belong to her, she said she preferred to risk eviction, making as much income as she could until then. Figure 9.5.1a, Figure 9.5.1b and Figure 9.5.1c are photographs of three different dormitories that rent rooms. The photographs show that the dormitories have large, pleasant outdoor spaces for people to socialise in. Figure 9.5.1d shows a photograph of a room rental within one of the houses.



Figure 9.5.1a: A dormitory with large, pleasant outdoor spaces for people to socialise in. Source: the author



Figure 9.5.1b: A second dormitory with large private open space with a table and an outdoor bed. Source: the author



Figure 9.5.1c: A third dormitory with large private open space with a table.
Source: the author



Figure 9.5.1d: A photograph of a room rental within one of the houses in Roi Krong. Source: the author

9.5.2 Access to services

Electricity and piped water has been available in Roi Krong since 1974 (RK27, an elderly woman). However, a small number of unregistered homes currently do not have access to either because they are not registered. The drive to formalise land tenure and housing has resulted in new buildings being denied access to water and electricity unless they are officially registered with the district government. The enforcement of this law angers some of the unregistered houses that blame Baan Mankong

programme for disrupting the informal system (RK29, and elderly man; RK32, an elderly woman). The neighbourhood is in the process of filling in paper work to get the district authority to move land-based electricity poles into the canal. Inland electricity poles are impeding some of the home reconstruction because people do not want to build their homes around a pole; instead they prefer to wait until the poles are relocated. The Electricity Generating Authority of Thailand, believed to be the relevant authority, was unresponsive to neighbourhood requests to move them. The neighbourhood now has an application in with the district authority to move the poles (RK27, an elderly woman).

Household waste currently drains directly into the canal. Roi Krong does not have water treatment facilities or sewerage tanks; however, some of the newly reconstructed homes have their own sewerage filters (RK27, an elderly woman). One active member of the Baan Mankong programme said tanks would be installed when all the houses are constructed, however that seems to be a long way off with the current social divisions.

Even though Roi Krong does not pay rent for the land, the district authority has collected rubbish since 2004, from bins at the entrance of the neighbourhood. The district pays two women a monthly stipend of 2,500 Baht (GBP 46.00) each to collect rubbish (RK13, an elderly woman; RK14, an elderly woman; RK16, a middle-aged woman). Households prefer to do their own recycling to supplement household income (RK27, and elderly woman).

9.5.3 Community buildings and social divisions

There are three community buildings that have shared use: the health centre, the community centre and the *sala* or gazebo. All community buildings are based in the centre of the neighbourhood, and are within hearing access of the public speaker system. The health clinic and

community centre share a plot boundary as shown in Figure 9.5.3a. Those who are strongly opposed to Baan Mankong do not often frequent the health clinic or community centre. The district pays a small sum to a health volunteer to coordinate activities and manage the use of the building. The volunteer is also the head of the Baan Mankong programme. Baan Mankong uses the community centre for its meetings.



Figure 9.5.3a: Roi Krong's health centre (left) and community centre (right) used by Baan Mankong supporters. Source: the author

The third community building is the *sala*. There appears to be a tacit understanding that the *sala* is used by non-Baan Mankong supporters. Such was the case when the author validated findings in this neighbourhood. Baan Mankong supporters were not originally present and subsequently joined the meeting.

The *sala* is a large, metal structure with a corrugated iron roof. This area is used as a play space for children and as a location for meetings with the elected committee and its leader. Fold up tables and plastic chairs are

stored elsewhere and set up for meetings in this space. However, when the flood occurred people from both groups reported using the spacious *sala* to sort and distribute flood relief items. Figure 9.5.3b below shows a photograph of the *sala* used by the elected leader and his supporters.



Figure 9.5.3b: Roi Krong's *sala* used by supporters of the elected leader. Source: the author

Funding for all three structures came from the district authority. In principle, access to these facilities is open to everyone; however in practice, use of the structures is restricted and reflects the neighbourhood's social divisions. Figure 9.5.3c shows all three community buildings share a plot boundary.

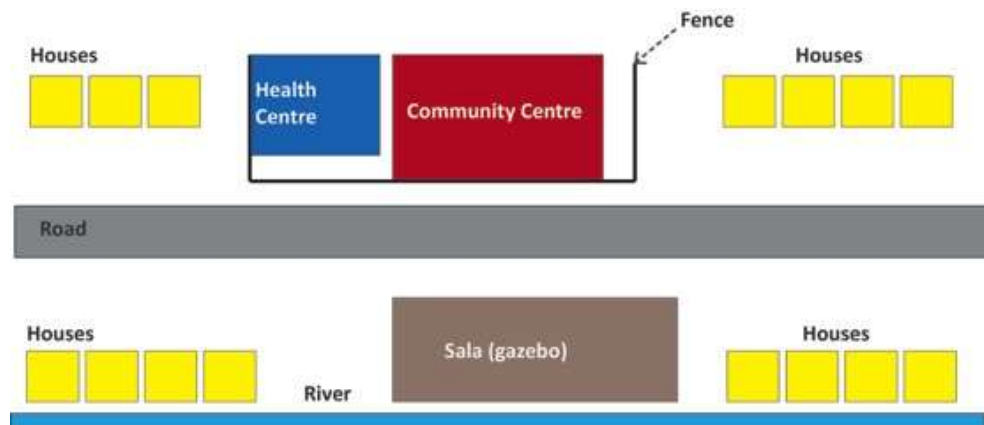


Figure 9.5.3c: A diagram of the community buildings in Roi Krong shows that all three buildings share a plot boundary, each with their own separate user groups. Source: the author

There is a notice board inside the community centre for posting updates to primarily Baan Mankong users of the centre. However, notices are also posted outside the community centre, on a cement fence, presumably to provide information to those who do not enter the area. Figure 9.5.3d shows a photo of the notice board inside the community centre and Figure 9.5.3e shows notices posted on the cement fence of the community centre.



Figure 9.5.3d: A notice board inside the Roi Krong community centre. Source: the author



Figure 9.5.3e: Important notices posted outside the Roi Krong community centre on its fence. Source: the author

While some people feel that community buildings are an opportunity to share and improve neighbourliness, others do not. When asked if the neighbourhood has improved its social dynamics after the flood one middle-aged man said, ‘Nothing here has changed since the floods. There are good people and bad people in this area. We know each other and who can be trusted. We know who is a thief and who we need to be suspicious of’ (RK20, 2014, a middle-aged man). This quote reflects the deep social divisions in Roi Krong.

Having explained the ways that CAS shaped and influenced the plots layer, several dimensions of resilience can be identified. Firstly, the homes reflect economic conditions of affluence and poverty. Secondly, income from rental properties creates social divisions, and is the root cause of opposition to upgrading. Thirdly, community building usage reflects the social divide within the neighbourhood. The next section will explain the way in which the dimensions of resilience within the different morphological layers were validated with people from Roi Krong.

9.6 Validating findings

The dimensions of resilience identified at the different morphological layers above were validated with 12 people from Roi Krong through a focus group discussion. Originally, supporters of the upgrading programme were not present at the focus group discussion. Validating the findings required the presence of both groups – supporters and non-supporters of the upgrading; therefore actions were taken to ensure the group had a balanced number of each. Once that was achieved the participants were read statements about the dimensions of resilience and asked to share why they agreed or disagreed.

Tensions in Roi Krong were higher than in other neighbourhoods so care was taken to ‘do no harm’ by giving both sides the opportunity to respond to the statements. Throughout the FGD discussion and original analysis three conclusions can be drawn regarding the most influential dimensions of resilience, and are presented below in the conclusions section.

Conclusion

This chapter identified the ways in which CAS shaped and influenced different morphological levels in order to identify key dimensions of resilience before, during and after the flood in Roi Krong. The chapter began with a neighbourhood profile of Roi Krong. It then provided analysis of four morphological layers including topography; movement networks and public open spaces layer; the plots layer; and the buildings and services layer. It then explained how key dimensions of resilience were validated with people living in Roi Krong through a focus group discussion. Three conclusions can be drawn regarding governance, economic and social dimensions of resilience within Roi Krong.

Firstly, power is concentrated in two key nodes, that is, those who support upgrading and those who oppose it. The group opposed to the upgrading

is largely more affluent and yields more power than the upgrading group and are therefore better able to obstruct any attempts at formalisation or change within the neighbourhood.

Secondly, remaining informal best suits the affluent and some of the poor. Large plots provide a lucrative source of rental income to the most affluent group in the neighbourhood. Poorer people seek out free land and cheap rent in Roi Krong's centralised location. To many people in Roi Krong, Baan Mankong offers little benefits. Afraid of debt or unable to afford debt, some financially vulnerable people prefer to stay with the current arrangement. Access to services such as running water and electricity were available to Roi Krong over 35 years ago. Community buildings and a health centre also exist without the need to formalise.

Thirdly, the development mechanisms used by Baan Mankong are not well understood or trusted. Therefore, with an underwhelming subscriber base, the savings group appeared to have limited success supporting people during and after the flood. The flood affected governance structures by revealing leadership interests and capabilities. For example, the Baan Mankong leader was viewed as a major contributor, while the elected leader was ousted in the next election cycle for not meeting expectations. The flood inconvenienced poorer residents in Roi Krong and set them back financially, but the political will and financial desire to build physical resilience into vulnerable homes is negated by the fact that floods in this area occur on a low frequency even though they carry high risk.

In summary, examining the impact of the flood in Roi Krong demonstrated the disaster entrenched an existing conflict with each of the two sides working together perhaps more than they normally would, but overall quite separately. Each group relied on its own existing contacts, networks and economic mechanisms for surviving and recovering after the flood. A

lack of ability to negotiate and lead at a neighbourhood scale fragmented the flood response and recovery. Having identified key dimensions of resilience at four morphological layers within each of the neighbourhoods, it is useful to compare and contrast in order to understand what can be generalised about all three of cases.

The next chapter will seek to highlight key findings across all three case studies and identify where it is possible to generalise about key dimensions of resilience.

Part IV. New contribution to knowledge

Chapter ten

Key findings from the case studies

Introduction

This chapter consolidates and re-interprets key findings from each of the individual case studies in order to establish cross-case dimensions of urban disaster resilience. Complex adaptive systems, known as CAS throughout, and urban morphology have been combined to interrogate humanitarian and development dimensions of urban disaster resilience within each of the three case studies, to demonstrate that the two urban analysis approaches can be combined to create intersections that define patterns of urban resilience. Dimensions of resilience indicate the point where human systems influence the built and natural environment and how they affect people.

Furthermore, the intersections of CAS and morphology, where the dimensions of resilience can be found, reflect the 'urban' aspects of disaster resilience by accounting for understandings such as complexity, fluidity and, importantly, the interdependencies that arise within and between the various layers and systems.

There are two parts to this chapter. Part I re-interprets the findings from previous individual case study chapters in order to determine key dimensions of resilience within each case study. To this end, key patterns of vulnerability and capacity within economic, governance and social CAS are revisited in order to enrich and validate the findings. The key dimensions of resilience are then allocated to the morphological layers they most influenced and conclusions about the dimensions of resilience are drawn. These layers encourage thinking about a checklist of issues that might not otherwise be thought about.

The intersection between CAS and morphology is where dimensions of resilience are identified. Identifying dimensions of resilience is important because they mostly influence the neighbourhood as a whole, enabling the neighbourhood to 'bounce back' from shocks and stresses. At times the dimensions of resilience may be positive or negative depending on the different perspectives as will be demonstrated in the re-interpretation of each of the cases.

Part II seeks to identify common dimensions of resilience across all three cases by comparing and contrasting the case studies at different morphological layers in order to generate links between the empirical findings and broader theory. These links allow the research to generalise its findings. Table 10.0 below summarises the two parts of this chapter.

Structure for identifying urban disaster resilience dimensions		
Part I	Re-interpreting individual case study findings to establish key dimensions of urban resilience	Key patterns within CAS are allocated to morphological layers and re-interpreted in order to determine key dimensions of resilience within individual case studies.
Part II	Establishing cross-case urban resilience dimensions	Generalisations about the key dimensions of resilience are made after a comparison between the three case studies.

Table 10.0: Chapter structure for identifying urban disaster resilience dimensions. Source: the author

Part I: Re-interpreting findings from individual cases

10.1 Bang Bua Neighbourhood

This section re-interprets findings from the Bang Bua Neighbourhood case study in order to determine patterns of CAS and identify key dimensions of resilience at four morphological layers.

10.1.1 Patterns of CAS

The *economic flows* that most influenced the resilience of Bang Bua Neighbourhood began with the formalisation of tenure security of the land. Secure land tenure made it possible to rebuild safe, robust homes through collective savings, loans and livelihoods skills building programmes. Economic investments protected people in Bang Bua Neighbourhood when the flood occurred by having a welfare fund that covered needs for things such as food, water and medicines during the flood. People in Bang Bua Neighbourhood did not need to evacuate to safer living areas because their upgraded homes provided a second storey retreat from the flood. After the flood, successful investments in economic measures could be seen in the limited damage to housing, which was

improved through savings and loans mechanisms. In terms of *governance networks* the new governance mechanism put in place during the upgrading proved to be an accountable and transparent mechanism, which laid the foundation for successful adaptation to a range of risks. With strong leadership, a decentralised structure and high levels of participation, the neighbourhood was skilled at working collectively to address chronic stresses and acute shocks. Overall road safety was increased through the use of collective problem solving. During the flood the governance mechanism adapted itself and its processes to continue to meet the needs of neighbourhood residents in an accountable and transparent manner. After the flood the neighbourhood continued working on collective problem solving and sharing their learning with other neighbourhoods endeavoring to upgrade around the country.

In terms of *social dynamics*, activities within the economic and governance systems built up a highly functioning social system within Bang Bua Neighbourhood. Relationships and trust between residents were developed through collective activities such as the savings groups and the problem solving of a range of chronic stresses. The success and scope of the social welfare system indicates the neighbourhood's capacity to build flexible mechanisms that meet the needs of a range of vulnerabilities. Essentially, the upgrading transformed the neighborhood's social identity in a positive way. During the flood, Bang Bua Neighbourhood residents significantly contributed to the capacity of the Canal Network and its ability to rival district governments in efficiency. By the end of the flood, the Bang Bua Network had grown significantly through the skills developed during activities undertaken before, during and after the flood. After the flood, social dynamics were perceived to have returned to pre-flood conditions. Table 10.1.1a below summarises the key findings from each CAS discussed in this section.

Bang Bua (Case 1): Patterns of CAS		
Economic Flows	Governance Networks	Social Dynamics
Before the flood		
Formalisation of land resulted in upgrading	New governance mechanism deemed accountable and transparent	Developed a social welfare system and greatly invested in it
Upgraded houses are robust and disaster resistant	Collective problem solving skills developed	Organised social events to build relationships
Savings, loans and livelihoods mechanisms were successful	More permeable roads increased safety though a neighbourhood watch approach to crime and violence	Upgrading transformed social identity
During the flood		
Savings group funded food kitchens	Sub-committee used to manage flood needs	Bang Bua Canal Network competed with district government regarding efficiency of flood response
Evacuation an elective, not a necessity because people lived in their second storey		Used Bang Bua Canal Network and neighbourhood partnerships secured donations
		Distribution hub for the Bang Bua Canal Network set up in Bang Bua Neighbourhood
		High levels of trust in the processes of managing distributions
After the flood		
Access to supplementary income through livelihood groups and loans	Focus on collective problem solving of chronic stresses continued	Bang Bua Canal Network expanded significantly
Homes received flood damage but were not destroyed		

Table 10.1.1a: A summary of the key patterns that arose from analysis of economic, governance and social CAS before, during and after the flood in Bang Bua Neighbourhood. Source: the author

Based on the patterns presented above, a summary of the dimensions of resilience within CAS in Bang Bua Neighbourhood is presented in Table 10.1.1b below. These nine elements significantly influenced the urban form of Bang Bua neighbourhood and the ways in which people's lives were affected by the built environment, which will be explained in the next section.

Bang Bua Case 1: Key Dimensions of Resilience Within CAS		
Economic	Governance	Social
Secure land tenure	Governance structures	Network and partnerships
Savings group	Agency	Social capital
Flood resistant housing	Safety	Social welfare fund

Table 10.1.1b: a summary of the key findings from each CAS discussed Bang Bua neighbourhood. Source: the author

10.1.2 Dimensions of resilience

This section presents an analysis of the dimensions of resilience within Bang Bua Neighbourhood, starting with topography and moving down to the buildings and services layer. Allocating resilience dimensions within CAS in table 10.1.1b to the morphological layer they most influenced offers a full picture of how CAS interact with the built environment to create dimensions of resilience. Dimensions are highlighted in italics when mentioned within each layer. Overall, all of the dimensions identified in Bang Bua Neighbourhood were positive and enabled the neighbourhood to adapt and transform as required in different circumstances. Before the flood these dimensions were integral to the neighbourhood's capacity to deal with chronic stresses. During the flood, the dimensions were adapted in order to ensure various parts of the neighbourhood maintain a basic functioning, which is responsible for the survival of Bang Bua residents. After the flood, the dimensions significantly impacted the rate of recovery and quality of life. Figure 10.1.2a below shows the dimensions of resilience

located at the intersections of CAS and morphology. Not all of the intersections are filled because only the most prominent dimensions were prioritised in the discussion.

Topography

Most of the CAS at the topographical layer were operating at city and national levels and therefore while the neighbourhood was greatly impacted by them, the neighbourhood itself exerted minimal impact on larger topographical systems. However, Bang Bua Neighbourhood did demonstrate impact and high level change by working with city-scale actors (primarily urban planners and the National Baan Mankong Upgrading Network) to adapt planning policy leveraging their *networks and partnerships*.

Movement networks and public open spaces

At the movement networks and public open spaces layer, governance mechanisms influenced the degree of *safety*, primarily by increasing the permeability of the road networks and developing public open spaces for children to play in and adults to socialise or sell merchandise.

Plots

Unsurprisingly, the plots layer in Bang Bua Neighbourhood was the layer most affected by newly introduced economic, governance and social CAS. The Baan Mankong programme targeted change at the plot layer by assisting the neighbourhood to achieve *secure land tenure* through the introduction of development mechanisms such as a *savings group*, and the new *governance structures* for the upgrading process, all of which contributed to building *social capital*. The savings group was able to achieve a small contingency of money that could be used as a *welfare fund*, resulting in a strong social welfare safety net. Together, the

development mechanisms at the plot layer resulted in a stronger sense of neighbourhood *agency*.

Buildings and services

At the buildings and services layer *flood resistant housing* was achieved through the dimensions of resilience introduced at the plots layer (savings mechanisms, governance mechanisms and social capital), resulting in an investment of money and reducing the risk of damage due to natural hazards such as fire and flooding.

Figure 10.1.2a below summarises the dimensions of resilience described above, plotting them on the relevant intersection between CAS and morphology.

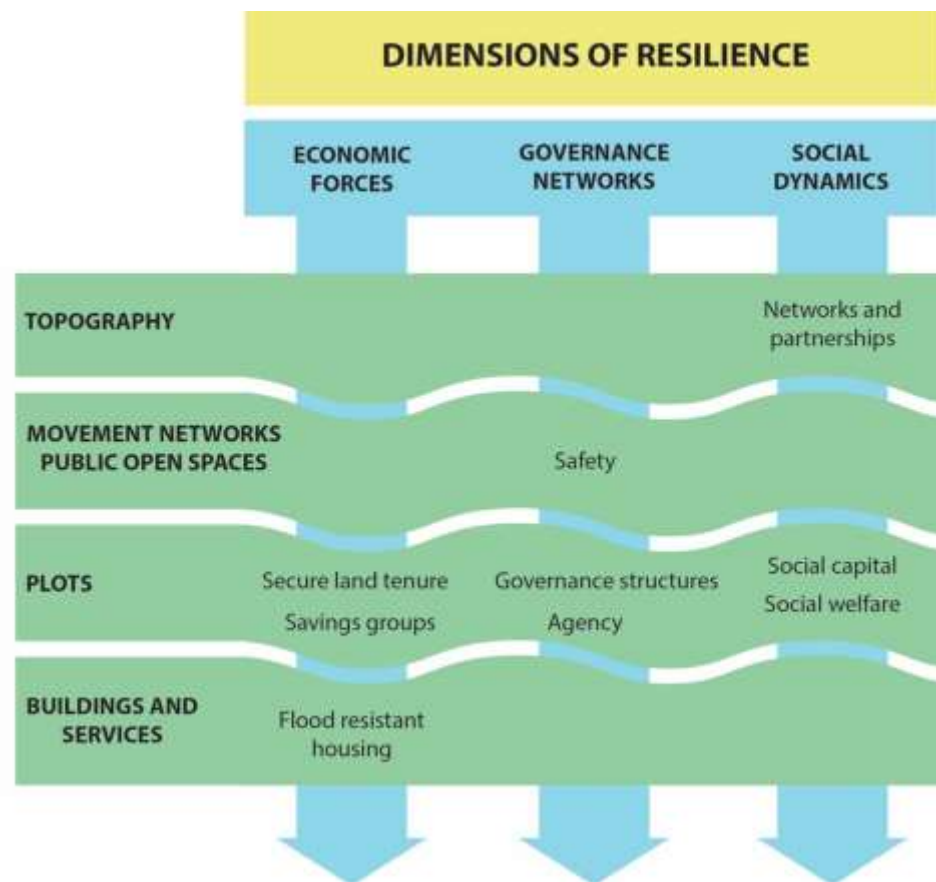


Figure 10.1.2a: The conceptual framework with dimensions of resilience from Bang Bua neighbourhood plotted at different intersections between CAS and morphological layers. Source: the author

10.2 Saphan Mai Neighbourhood

This section re-interprets findings from the Saphan Mai Neighbourhood case study in order to determine patterns of economic, governance and social CAS and identify key dimensions of resilience at four morphological layers.

10.2.1 Patterns of CAS

The *economic flows* that influenced the most change in Saphan Mai began with the legalisation of land. Secure land tenure enabled the neighbourhood to invest in a savings group that was moderately successful due to an initial lack of trust in the economic systems and mechanisms governing them. The flood served as an opportunity to build trust in the economic systems that created additional welfare funds to support neighbourhood residents with supplementary food. Due to a lack of safety during the flood, a significant number of people had to evacuate from their homes. However, soon after the flood all the homes managed to upgrade. For some this occurred due to an increase in trust in the economic systems and governance mechanisms; meanwhile a small minority agreed to upgrade because of the threat of a lawsuit and potential eviction if they did not cooperate.

Governance networks influenced Sapan Mai primarily because they were built on a conflict of interest, which reduced overall levels of trust. The lengthy time it took for the neighbourhood to upgrade demonstrates a moderate ability to self organise. That moderate ability was also apparent in the floods where there was a low-level of dissatisfaction regarding the way distributions were managed. However, the moderate degree of self-organisation has resulted in an ability to upgrade roads and therefore the overall level of neighbourhood safety. The imbalance of power continued after the flood and is reflected in the use of public open space and buildings. The *social dynamics* within the neighbourhood improved when

people saw financial mechanisms built a degree of redundancy into the social welfare system, enabling vulnerable families to be supported by it. The action of working together during the flood to manage social welfare activities built a level of trust in the governance systems for some. Table 10.2.1a provides a summary of the key themes that arose from the analysis of Saphan Mai.

Saphan Mai (Case 2): Patterns of CAS		
Economic Flows	Governance Networks	Social Dynamics
Before the flood		
Growth of savings group hindered by lack of trust	New governance mechanism built on a conflict of interest	Minimally reliant upon external partnerships and link with the Bang Bua Canal Networks
Lack of trust in economic systems limited the number of flood resistant houses built	Moderate ability to self organise for meetings and activities	Upgrading created high social capital in the upgrading group
Formalisation of land enabled upgrading for some	More permeable roads resulted in increased safety	
During the flood		
Savings group funded food kitchens, which built trust	Low-level dissatisfaction of distribution of donations	Flood became an opportunity to work together
Single storey homes evacuated due to lack of safety		Moderately reliant upon external partnerships and link with the Bang Bua Canal Networks
After the flood		
All homes upgraded to flood resistant homes	Imbalance of power reflected in use of public open space and buildings	Built environment upgraded but with tares in social fabric
	Legal structures forced participation in upgrading	

Table 10.2.1a: A summary of the key patterns that arose from analysis of economic, governance and social CAS before, during and after the flood in Saphan Mai. Source: the author

Based on the themes presented above, a summary of the dimensions within CAS in Saphan Mai is presented in Table 10.2.2b below. The eight dimensions significantly influenced the urban form of Bang Bua neighbourhood and the ways in which the built form affected people, which will be explained in the next section.

Saphan Mai (case 2): Key Dimensions of Resilience Within CAS		
Economic	Governance	Social
Secure land tenure	Governance structures	Network and partnerships
Savings group	Self-organisation	Social capital
Flood resistant housing	Safety	

Table 10.2.1b: A list of key dimensions of resilience within economic, governance and social CAS in Saphan Mai. Source: the author

10.2.2 Dimensions of resilience

After more than a decade of upgrading, Saphan Mai managed to build the physical resilience of people in the neighbourhood by enabling residents to invest in homes that are safe and robust. For the greater part of a decade a minority of people did not see their financial and social capacities grow because they resisted participation in the mainstream activities of the neighbourhood. Some chose resistance to upgrading because their physical and economic resilience was already high with adequate income earning potential and robust homes. Individuals with low-income earning potential and low-quality homes were less resilient and benefitted most from the identified dimensions of resilience.

As a whole, the neighbourhood is physically more resilient after the 2011 flood than it was before the flood occurred. Figure 10.2.2a below shows the dimensions of resilience at different intersections between CAS and morphological layers. A description of each of the dimensions is given in the section below with dimensions identified in italics.

Topography

Much like Bang Bua, Saphan Mai's primary influence at the topographical layer was through *networks and external partnerships* with the Lak Si district government and other city-scale actors to adapt planning policies that resulted in legal and safe construction within the neighbourhood.

Movement networks and public open spaces

At the movement networks and public open spaces layer wider roads that better permeated the neighbourhood created a greater sense of *safety* due to high levels of footfall and greater visibility of public open spaces.

Plots

In the plots layer the greatest degree of change can be seen, because like Bang Bua, Saphan Mai was able to negotiate *secure land tenure* through the formulaic Baan Mankong *saving group* and *governance structures*. While there was a minimal degree of conflict in Saphan Mai, most of the neighbourhood was able to *self-organise* before the flood and during. Improvements to the ways in which the neighbourhood works together occurred after the flood when levels of *social capital* increased after people worked together to survive.

Buildings and services

In the buildings and services layer, it can be concluded that before the floods, a majority of the physical infrastructure was upgraded but at the cost of tearing holes in the social fabric. However, those who did not participate in home reconstruction before the flood did so after, because to a greater or lesser degree, the benefits of *flood resistance housing* were realised during the flood.

Figure 10.2.2a below summarises the dimensions of resilience described above, plotting them on the relevant intersection between CAS and morphology.

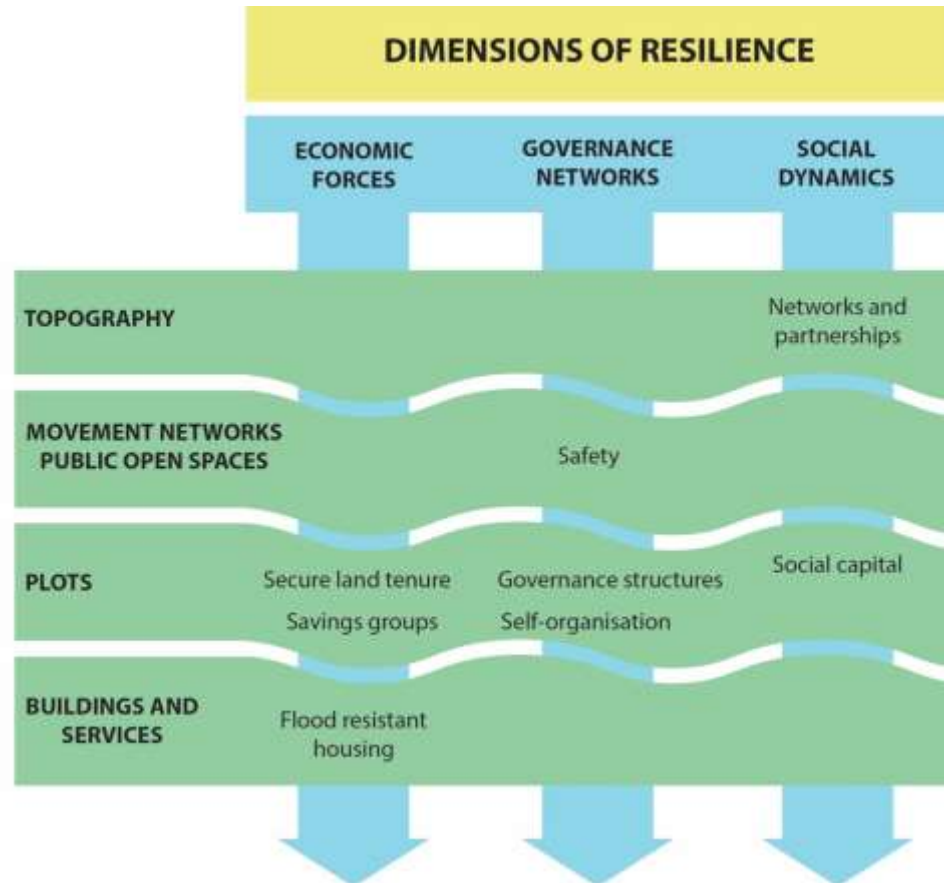


Figure 10.2.2a: The conceptual framework with dimensions of resilience from Saphan Mai neighbourhood plotted at different intersections between CAS and morphological layers. Source: the author

10.3 Roi Krong Neighbourhood

This section re-interprets findings from the Roi Krong Neighbourhood case study in order to determine patterns of economic, governance and social CAS and identify key dimensions of resilience at four morphological layers.

10.3.1 Patterns of CAS

The *economic flows* in Roi Krong are the least similar of all the neighbourhoods. To begin with, an informal land status best suits the affluent people in the neighbourhood who earn income from room rentals in dormitories that have been abandoned by Rajabhat University. It also suits poorer people who do not want to go into debt or believe they cannot afford to. Due to an inability to negotiate a land sharing agreement throughout the neighbourhood via Baan Mankong, only 25 houses have been upgraded and 12 repaired out of total of 135 homes. The lack of support for Baan Mankong has resulted in a limited interest in the savings group. A lack of large support based means the savings group is limited in its ability to offer social welfare and to financially support people before and after the flood. During the flood approximately 40 per cent of the neighbourhood evacuated, primarily people from single storey homes (including renters). Access to loans after the flood was a challenge for people living in Roi Krong.

In terms of *governance networks* Roi Krong also stands out as different in the systems it hosts. When Baan Mankong arrived two nodes of power formed, each with its own governance mechanism (one node is organised under the Baan Mankong scheme, the other is through official election channels). The Baan Mankong governance structure does not seem to be well understood or widely trusted in Roi Krong. During the flood the Baan Mankong governance structure seemed to prove itself as capable and trustworthy. Meanwhile, the past elected leader was perceived within the neighbourhood as corrupt. After the flood, healthy democratic processes were demonstrated when the elected leader was replaced in the next election cycle. Meanwhile, the use of public spaces and buildings reflects the power dynamics with each governance structure having its own communal space to meet in.

In terms of *social dynamics*, each governance structure created its own partnerships and network. For example, the Baan Mankong upgrading group relied on support from the Bang Bua Canal Network while the elected leader sought support from his political party connections. During the flood, the two governance structures reported to work together more than they normally would have; however, after the flood the tensions resumed and the upgrading conflict remained entrenched. Table 10.3.1a provides a summary of the key patterns of CAS interactions that arose from the analysis of Roi Krong.

Roi Krong (Case 3): Patterns of CAS		
Economic Flows	Governance Networks	Social Dynamics
Before the flood		
Remaining informal best suited the affluent and some of the poor; 25 houses out of 135 were reconstructed and 12 repaired through Baan Mankong	The upgrading created two governance structures: 1.) Baan Mankong and 2.) Elected leadership recognised by the district authority	External partnerships and networks created for governance structure
Undersubscribed support base for savings group limited the group's ability to create impact	Development mechanisms such as savings groups and governance structures used by Baan Mankong were not well understood or trusted	
Affluent people had flood resistant homes		
During the flood		
Poorer groups inhabited single storey homes, which had to be evacuated (about 40% of the neighbourhood)	Leadership of Baan Mankong governance structure proved itself; elected leadership perceived as corrupt and later voted out	Baan Mankong group relied heavily on the network; elected leader relied on political party connections
	Leaders were more passive than active in receiving and managing aid assistance	During the flood the two governance structures worked together more than they normally would have
	Lack of ability to lead a neighbourhood scale response due to leadership fragmentation	
After the flood		
Access to loans required	Each governance structure used different public open spaces and buildings	The existing community tensions related to upgrading remained entrenched after the flood
Income from room rentals highly valued and therefore the rental market was shielded from change	Healthy, democratic processes enabled a turnover in elected leadership due to perceived corruption	

Table 10.3.1a: A summary of the key patterns that arose from analysis of economic, governance and social CAS before, during and after the flood in Roi Krong. Source: the author

Based on the themes presented above, a summary of the four dimensions of resilience identified in Roi Krong is presented in Table 10.3.1b below. The limited dimensions of resilience reflect low levels of overall resilience in Roi Krong compared to the other case studies and will be further explained in each layer below. The dimensions that are listed in the table below are plotted on the conceptual framework at the layer where they had the most influence in Figure 10.3.2a. The plotting of the dimensions reflects the interaction of CAS with the morphological layers.

Roi Krong (case 3): Key Dimensions of Resilience Within CAS		
Economic	Governance	Social
Room rentals	Healthy democracy	Network and partnerships
	Safety	

Table 10.3.1b: A list of key dimensions of resilience within economic, governance and social CAS in Roi Krong. Source: the author

10.3.2 Dimensions of resilience

Overall, Roi Krong Neighbourhood managed to resist major changes to its built environment due to a small group of people who occupy land and buildings critical to transformation. Currently, that group of people is the most resilient because they have control over land, a scarce resource in Roi Krong. Meanwhile, poorer people remain physically and economically vulnerable to disaster shocks and chronic stresses because of the state of their homes, lack of earning potential and a lack of access to loans. The observation that there are ‘winners’ and ‘losers’ in every neighbourhood in regards to resilience is reflected in the following statement by Bahdur and Tanner who write that: ‘Trade-offs between different groups seeking resilience become particularly accentuated in densely populated urban contexts where an increase in one household’s resilience can lead, very quickly, to the enhanced vulnerability of another’ (2014, p.204). In Roi Krong, resilience is about negotiating ‘social and economic fault lines’

(Bahadur and Tanner, 2014, p.206) within the neighbourhood. As with the other case studies, the dimensions of resilience in Roi Krong are indicated at the intersections between CAS and the morphological layers where the most influence was evidenced, and presented in Figure 10.3.2a below.

Topography

Like Bang Bua neighbourhood and Saphan Mai, Roi Krong did not have much influence at the topographical layer until the neighbourhood joined *networks and partnerships* as it did when the neighbourhood upgrading group linked with the Bang Bua Canal Network and the elected leadership group linked with political parties.

Movement networks and public open spaces

At the movement and public open spaces layer only one dimension of resilience was identified. The aspect of *safety* within Roi Krong did not change and remained tenuous. This is an example of 'bouncing back' to an undesirable state. Perhaps this is because as stated earlier, the upgrading caused a split in the neighbourhood resulting in the inability for the neighbourhood to work together as one. Therefore, upgrading roads and adding lights for safety did not occur in Roi Krong as it did elsewhere because without security of tenure, people were not willing to invest in neighbourhood infrastructure, including roads and public open spaces.

Plots

At the plots layer neighbourhood upgrading was rejected because remaining informal best suited both more affluent people and some of the poorest. Affluent houses did not need or want to upgrade; nor did they want to lose the extra space used for room rental income. In terms of governance, a separation of power can readily be seen at the plots layer as a direct result of the Baan Mankong upgrading. However, the existing governance mechanisms were willing to share power with the newly

formed Baan Mankong mechanism that governed the upgrading programme, signaling a *healthy democracy*. Moreover, after the flood the neighbourhood held elections and voted in a new leader based on dissatisfaction with the way the previous leader managed the flood response.

Buildings and services

In the building layer, room rentals were a key dimension of resilience. The room rentals were a source of contention and one of the primary reasons land sharing agreements – and most likely the other development mechanisms – did not have a high success rate in Roi Krong. Room rentals further highlight that resilience for one group, for instance the controllers of property and buildings, does not equal resilience for another group such as people living over the canal in shanty homes who want to upgrade.

It is important to note that the presence of room rentals is not a wholly negative dimension of resilience in Roi Krong; a number of urban poor in the neighbourhood require affordable rental housing in a central location in order to access higher paying work. Therefore, the rental properties are an important asset to renters and could offer greater physical resilience to natural shocks if they were constructed more robustly.

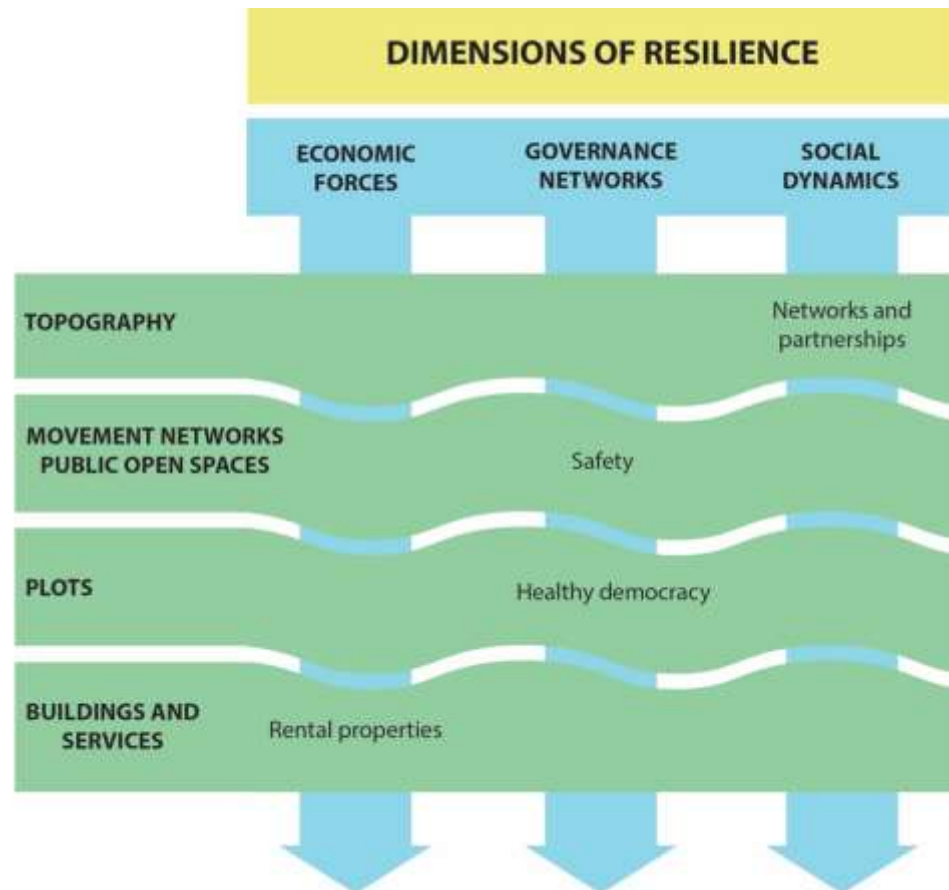


Figure 10.3.2a: Dimensions of resilience from Roi Krong neighbourhood indicated at the intersections between CAS and the morphological layers where the most influence was evidenced.

In summary, each neighbourhood has its own unique complex economic, governance and social CAS patterns. Bang Bua Neighbourhood and Saphan Mai had the most similar patterns while Roi Krong stood out for having fewer patterns that stray from the established patterns of the other two cases as shown below in Figure 10.3.2b. Reasons for the patterns and deviations will be provided in Part II of this chapter where cross-case dimensions of resilience are explained.

Dimensions of Urban Disaster Resilience		
Bang Bua Neighbourhood	Saphan Mai Neighbourhood	Roi Krong Neighbourhood
Economic flows		
Secure land tenure	Secure land tenure	Rental properties
Savings group	Savings group	
Flood resistant housing	Flood resistant housing	
Governance Networks		
Governance mechanism	Governance mechanism	Healthy democracy
Agency	Self-organisation	Safety
Safety	Safety	
Social Dynamics		
Network and partnerships	Network and partnerships	Network and partnerships
Social capital	Social capital	
Social welfare		

Table 10.4: An overview of the key dimensions of resilience within economic, governance and social CAS in Bang Bua, Saphan Mai and Roi Krong neighbourhoods. Source: the author

Therefore, Part I of this chapter re-interpreted findings of individual case studies in terms of the patterns of economic, governance and social CAS as well as how they were articulated as dimensions of resilience when plotted on different morphological layers. Next, Part II of this chapter will establish cross-case dimensions of resilience by comparing the case studies in order to identify what can be generalised.

Part II: establishing cross-case urban resilience dimensions

Within each morphological layer key dimensions of resilience have been identified. Not all of the dimensions of resilience are positive, or are seen as positive by everyone. Some of the dimensions identified within the different layers helped neighbourhoods to ‘bounce back’ and stay in a relatively similar state to before a shock or stress occurred. However, other dimensions of resilience have helped neighbourhoods and

individuals to 'bounce forward' or transform into a state that allows them to better cope with shocks and stresses. Analysis of the cross-case dimensions of resilience within each layer looks at patterns of the identified dimension of resilience before the flood, during and after, before drawing conclusions about the dimension of resilience, including whether it is positive or negative and for whom.

10.5 Dimensions of resilience within the topographical layer

The topography layer illustrates that civil society networks and partnerships became an important source of support to poorer people. Two key networks were revealed at the topographical layer. The first was the Bang Bua Canal Network of 12 neighbourhoods. The second was the National Baan Mankong Upgrading Network of 1,546 communities in 277 cities (Wungpatcharapon and Tovivich, 2012b). This topography layer explains how urban poor networks were effective in the collective production of knowledge; their ability for self-representation; and filling in gaps when governments were ineffective.

10.5.1 Urban poor networks and the collective production of knowledge

Through networks, groups of urban poor people were capable of collectively producing knowledge (Reed et al., 2014) and learning from one another. The Bang Bua Canal Network enabled 12 participating neighbourhoods to share good practice. For example, Saphan Mai Neighbourhood had difficulty operationalising its savings group and drawing in a large membership base, so its leadership committee visited Bang Bua Neighbourhood and others to share ways of overcoming savings group start up difficulties (KI14, a local aid worker; KI34, a neighborhood leader). Neighbourhoods in the network also worked together on strategies and mechanisms to reduce pollution. For example, a 'grease

trap' was designed in one neighbourhood and distributed throughout the entire canal network as an inexpensive way to treat wastewater. Although the grease trap is no longer in use today, it succeeded in creating relationships and bonds within a group of people united by a single cause (FGDBB1). Meanwhile the larger, nation-wide Baan Mankong Upgrading Network aided in flood preparedness for the 12 neighbourhoods that volunteered to travel to flood-affected neighbourhoods in northern Thailand in order to learn about flood readiness and response as a means of preparing their own neighbourhoods and systems. The exchange of learning was especially helpful because information regarding when the flood would arrive and where it would hit was often conflicting, which made it difficult for people to prepare.

10.5.2 Urban poor networks demonstrate a capability for analysis, self-representation and agency

It is argued here that an increased capability for analysis, self-representation and agency can be seen through examining the two networks' response to shocks and stresses.

Capability for analysis

The Bang Bua Canal Network increased its capacity to collectively analyse problems through repeated attempts to solve wide-spread problems such as pollution. As a network the group cleaned the water and worked with the government to dredge the canal (KI3, a senior leader in a local aid agency; FGDBB1).

Further examples of analysis can be found during the disaster. After leaders returned from their learning exchange in other flood-affected areas, they decided that each neighbourhood required its own boat for distributions and sought funding from CODI to purchase boats (KI33, a neighbourhood leader).

Self-representation and agency

Once the flood occurred, the Bang Bua Canal Network actively sought support from its external partners, i.e. the military, aid agencies, universities and politicians. The network had the capability and importantly, the trust by its members and partners to manage the distribution of donations. It is at this juncture where we begin to see examples of agency, a term often used to describe those who act independently and are freely to make their own choices (Brown and Westaway, 2011). One of the consequences of ineffective government disaster management policies is that assistance did not arrive in Bang Bua Canal for seven days. During that time the network created its own food kitchens, having the financial means and social ability to self organise to support the basic needs of large numbers of people. Agency can also be seen in 2004, when the Bang Bua Canal first formed the network and worked together to avoid eviction by the government (discussed in Chapter five, section 5.4).

10.5.3 Where government actions came up short, networks and their partners fill the gap

The Bang Bua Canal's upgrading network engaged with a range of city and national scale stakeholders to build resilience. During the upgrading, the network partnered with architects, planners, district authorities, the municipality, aid agencies and universities. For a period of ten years relationships grew between the canal network and the previously mentioned stakeholders. When the 2011 flood occurred, the network and its partners adapted the ways in which they worked together. For example, medical students from universities provided health care advice and engineering students taught people how to prevent electrocution.

In fact, the Bang Bua Canal Network rivaled Bang Khen and Lak Si district governments in terms of having the ability to quickly procure aid and effectively distribute it (KI33, a neighbourhood leader; KI36,

neighbourhood leader; KI38, an officer from Bang Khen district). Moreover, because the district governments were perceived as less effective than the Bang Bua Canal Network, neighbourhood membership in the canal network had grown from 18 to 38 neighbourhoods (KI33, a neighbourhood leader; KI32, a neighbourhood leader) by the end of the flood.

In conclusion, the generalisable key finding within the topography layer is that in crisis situations where government policies and frameworks are ineffective, networks and partnerships take on a more active role, especially within poorer urban populations. Having said that, resilience thinking at the national level must not expect populations to replace the role of government. Therefore national level governance and policy contexts ought to be taken into account in order to reduce political vulnerability (Bahadur and Tanner, 2014) in addition to building social resilience. Therefore, networks should engage with national and municipal level disaster management and urban planning policies to build a greater degree of resilience.

10.6 Dimensions of resilience within the movement networks and public open spaces layer

Economic and social use of movement networks and public open spaces offer insights into power dynamics. Who is included in the social and economic interactions that take place on roads and in public open spaces demonstrates that power is a relational effect, an outcome of social interaction. Allen (2003) notes that the ways in which spaces are constructed, their layout and uses, serve as a resource of power and a means through which power is exercised. He therefore argues that 'particular places may play host to a variety of cross-cutting arrangements

of power' and that '...if power has a presence at all, it has it through the interplay of forces established in place' (Allen, 2003, p.11). This movement networks and public open spaces layer reveals three dimensions of resilience: safety, inclusivity and income generation.

10.6.1 Safety

The upgrading process prioritised the creation and improvement of roads and public open spaces, which contributed to an overall greater sense of safety and security in the Bang Bua Canal. For example, major pedestrian lanes were introduced and expanded creating more permeability while the installation of lights provided better visibility. Smaller alleys were designed with a high degree of connectedness to the major pedestrian lane in two of the neighbourhoods, arguably contributing to safety by increasing footfall in previously isolated areas. Jacobs (1961b) writes that public peace is kept not by police, but by the public itself through people having 'eyes on the street' when there is 'continuous use', which turns human activity into interesting activity to watch. In terms of public open spaces, children's right to play in safe, child-friendly spaces was prioritised through the design of public open spaces at the centre of all three neighbourhoods. Prior to the upgrading children used to play in parking lots, at risk of vehicular related accidents and within reach of strangers. Assimilating children through safe places to play in their neighbourhood creates spatial autonomy for social interaction, and turns public open spaces into grounds where children can develop and test their identity in relation to their peers (Travlou, 2007).

10.6.2 Inclusiveness

Social inclusion is the second dimension of resilience identified within the movement networks and public open spaces layer. The increased coverage of the pedestrian lanes also increased the capacity for socialising. Canal dwellers parked their motorcycles in pockets of open space when visiting one another and were observed sitting outside watching activities taking

place on the pedestrian lanes. However, examination of public open spaces also reveals findings about the experience of inclusion in the Bang Bua Canal. As discussed above, children are included through the intentional creation of open space. Their caregivers, usually elderly relatives, are also included because the space is within a short walking distance of all neighbourhood homes and is a pleasant area for adults to gather, socialise and supervise younger children. In Saphan Mai adults used the open space for formal neighbourhood meetings. In Roi Krong a big public open space existed before the flood, but since tensions have become further entrenched the two governance groups have further segregated themselves by using separate public open spaces to conduct meetings.

10.6.3 Income generation

The roads are enablers for people to generate income; therefore income generation is included as the third dimension of resilience at the movement networks and public open spaces layer. In Bang Bua Neighbourhood the creation of a canal-based pedestrian lane resulted in an increase of vendors accessing the area with goods to sell. Small portions of the road in Bang Bua and Saphan Mai are used for storing goods related to income generation, such as vending carts or goods for recycling. In Roi Krong the main road remains narrow and accommodates few vendors.

When the 2011 flood struck, roads and other public open spaces were completely submerged, and therefore of little use to residents. Neighbourhood leaders participating in Baan Mankong prioritised mobility in their preparedness efforts through the decision to preposition one boat per neighbourhood in order to assist with the distribution of aid. Free public transportation offered at a city-level enabled some poorer people to continue working at their regular jobs or to innovate ways to earn

money by travelling great distances to markets and reselling goods on rafts. Overall, mobility was underscored as extremely important to residents because they needed to access different parts of the city to access to food, education, health care, jobs and other such daily routines that enable survival and well-being. After the floodwaters receded, Bang Bua Neighbourhood resumed patterns of economic and social activities that took place before the flood. The robust roads sustained little to no damage, resulting in a quicker recovery. Meanwhile, Saphan Mai placed great emphasis on rebuilding roads after the flood, having the opportunity to widen parts of the primary pedestrian lane and create smaller alleys that increased the permeability of the neighbourhood when 45 additional houses agreed to land share and reconstruct their homes through Baan Mankong.

In summary, thoughtfully designed and well maintained roads and public open spaces become a panoply of social and economic activities that promote safety, inclusivity and income generation for users.

10.7 Dimensions of resilience within the plots layer

The incremental upgrading of individual and neighbourhood plots within the Bang Bua Canal is an example of a development methodology that has been tested by disaster. The primary observation is that development mechanisms founded on social capital can be a reliable neighbourhood-scale response system during and after a disaster. However, this finding does not mean that the systems should work in isolation, instead they should consider horizontal links with multi-sectoral actors within each of the different morphological layers (such as architects who helped design buildings and city planners who made planning regulations flexible enough

to suit the context in Bang Bua). Kropf (2009) argues that analysis of those who control the use of plots and those who use them can provide essential insights into the nature of socially defined relationships. In the case of the Bang Bua Canal, analysis of the users and the ways in which plots are controlled reveal four key dimensions of resilience that transformed plots.

10.7.1 Land tenure

The first dimension is secure land tenure, and the ways in which chronic stresses and sudden disaster shocks prompted the need for canal residents to rethink tenure security. In 2000 the looming threat of eviction instigated a multi-sectoral approach to upgrading between 12 neighbourhoods to quiet the conflict potentially brewing between the land owner (the national government) and canal dwellers. Hardoy and Satterthwaite (1989) write that where there is no conflict between landowners and the inhabitants, governments are less likely to bulldoze illegal developments, citing Bangkok as an example of illegal sub-divisions of land often escaping demise. Individual financial investments in buildings, roads and public spaces are risky without tenure security. Bang Bua Neighbourhood seized the opportunity to secure land tenure and reconstructed all of its homes within two years after a year of planning had taken place. In Saphan Mai, having tenure security was also important before people invest in buildings and common infrastructure. However, the process of securing tenure took nine years in Saphan Mai due to a number of factors including lack of trust in financial mechanisms and governance mechanisms. After the 2011 flood, more trust appeared to have been built amongst the residents and a majority of the 45 houses that had not undergone construction, began to engage in the upgrading process. Moreover, a legal mechanism had been put in place to potentially sue 17 houses that were living on cooperative land without paying rent (see Chapter Eight). Meanwhile, in Roi Krong while people desired tenure

security in principle, formalization was resisted partly because of unwillingness for more affluent people to participate in land sharing in addition to fragmented social capital.

10.7.2 Savings groups

The second dimension of resilience within the plot layer is financial mechanisms. Through cross-case analysis it can be concluded that for poorer urban individuals financial access is often dependent upon social capital at the neighbourhood level. As was explained in Chapter Five, savings groups were important mechanisms for poorer people to collectively pool resources in order to access low interest loans. Such loans were then used to reblock plots, reconstruct homes, invest in common urban infrastructure as well as initiate a social welfare fund (discussed in Chapter Five, section 5.3). After the 2011 flood, neighbourhood savings groups provided small loans with an even lower interest rates to members who needed money to invest in activities such as restarting livelihoods or paying school fees. The savings group worked as a mechanism for building social capital because of the collective way in which people worked together to manage their money. Transparent and accountable processes and management committees earned trust amongst members and formed relationships and bonds. Those who did not participate in savings groups either had alternative means of accessing finances (through loans from employers or family members, for example) or felt they could not afford to participate because the investment cost was too high. However, the evidence across all three case studies shows that poorer people who participated in collective financial mechanisms were able to afford to transform their individual plots and associated infrastructure.

10.7.3 Governance structures

The third dimension of resilience within the plots layer is governance structures. Cross-case study analysis found that democratic formal and

informal governance mechanisms are amenable to power sharing and adaptable to crisis and non-crisis situations. Seeliger and Turok (2014) argue that adaptive governance is an appropriate framework for building resilience by strengthening local capabilities beyond 'managing' informal settlements to positively integrating into the wider city. Adaptive governance involves increasing security and social cohesion; reducing vulnerability arising from spatial patterns; increasing employment opportunities; and encouraging innovation (Seeliger and Turok, 2014) amongst other such activities witnessed at the plot level in all three neighbourhood case studies.

The case studies showed that governance structures are most successful when they are transparent, accountable and equitable, regardless of whether they are formal or informal. In Bang Bua Neighbourhood there appeared to be a large level of satisfaction with the elected leader's ability to manage the formal neighbourhood duties as well as the upgrading activities. Bang Bua Neighbourhood's governance structure was decentralised and therefore enjoyed high levels of participation in activities such as census data collection. When the 2011 flood occurred, the method for collecting census data was adapted for assessing needs and monitoring distributions with what was described as a satisfactory method by most people in Bang Bua neighbourhood.

In Saphan Mai, the new upgrading governance structure displaced an old power structure and was built on a conflict of interest with a husband standing as the elected leader, his wife as the leader of the upgrading activities and their daughter as the accountant of both structures. The governance structure in Saphan Mai can be described as lacking transparency and accountability. However, it was chosen through democratic means because most of the residents in the neighbourhood are relatives or friends of the family in power (discussed in Chapter Eight).

In Roi Krong the introduction of Baan Mankong created two governance structures. When the flood struck each structure relied on its own previously established network of peers for support. After the flood the leader was replaced in the next neighbourhood election cycle due to dissatisfaction with his performance, demonstrating the existence of a healthy democracy.

10.7.4 Social capital

The fourth dimension of resilience identified at the plots layer is social capital. Here Archer's (2009) theory of three levels of social capital – bonding, a function of intra-communal relations; bridging, inter-communal relations; and linking, a function of community relations with the state – offers a framework for understanding the ways in which social capital impacted the plots layer. The first level of social capital, 'bonding', is evidenced most when neighbourhoods attempted to create equity amongst social and financial inequities. For example, through the upgrading neighbourhoods engaged in a number of collective activities such as the celebration of Mother's and Father's Day. Neighbourhoods worked together to plan new roads, redistribute plots of land and develop public open spaces. Each neighbourhood has its own social welfare system (as described in Chapter Five, section 5.5) to assist families whose financial assets were depleted. When the 2011 flood struck, neighbourhood welfare systems funded small food kitchens until outside assistance reached the neighbourhoods. In Bang Bua Neighbourhood, the decentralised and participatory system used to manage distributions contributed to an overall feeling of trust in regards to how distributions were handled. In Saphan Mai, a connection was built between opposing groups with some understanding and trust generated through a leadership structure that was reportedly top down in nature, yet largely equitable in its approach to assisting the neighbourhood, according to the majority of key informant interviews. In Roi Krong, the two governance structures

worked together temporarily during the floods but returned to their entrenched positions and existing tensions after the flood.

The 'bridging' form of social capital, a horizontal linkage between neighbourhoods within the canal and more broadly across the country, is demonstrated through the Bang Bua Canal Network. As stated earlier leaders in the Canal Network deployed to flooded parts of northern Thailand to gain flood preparedness and response experience. The Bang Bua Canal Network was especially utilised by Roi Krong due to the fact that it was the weaker, smaller governance structure in the neighbourhood and therefore relied more heavily on the connections and partnerships harnessed by the whole canal. Even before the flood occurred there was evidence of inter-communal relationships through anti-drug trafficking efforts such as the annual drug-prevention day (discussed in Chapter Five) and canal-wide attempts to reduce pollution (also discussed in Chapter Five).

Evidence of the 'linking' form of social capital can be observed before the flood at a minimal level when the neighbourhood leaders worked with Bang Khen district (where Bang Bua and Roi Krong neighbourhoods are located) and Lak Si district (where Saphan Mai is located) to move electricity poles from the land side into the canal and during negotiations for a retaining wall that prevents the canal bank from collapsing once houses have moved to the land side. When the flood occurred one key informant from the Bang Khen district office said that the Bang Bua Canal Network regularly sent one representative to attend district flood response meetings. Interviewees from Bang Khen and Lak Si districts said that their main source of frustration was that they were not as equipped and well-resourced to provide flood assistance as the Bang Bua Canal Network (KI 37, Lak Si district officer; KI 38, Bang Khen district officer).

Upon examining the plots layer through the lens of Archer's three types of social capital (bonding, bridging, linking) collaboration across multiple sectors with a range of stakeholders can be observed. The collaboration patterns in crisis and non-crisis times in the Bang Bua Canal infer that an area-based approach to disaster resilience is taking place. Parker and Maynard (2015) define area based approaches as 'geographically targeted'; 'multi-sectoral'; and 'participatory'. Presently, there is a call for a shift in paradigm in humanitarian assistance by agencies like ISAC, USAID, OFDA, ECHO and the Global Shelter Cluster (GSC) to assist entire neighbourhoods, rather than individual households (Parker and Maynard, 2015). The generalisable key finding from the plots layer is that the humanitarian sector is retrofitting proven development tools and methodologies such as settlement upgrading into humanitarian frameworks. While there are barriers to using development methodologies in humanitarian contexts, especially during the relief phase when time frames for saving lives is short, from an early recovery stage development approaches have been observed in the Bang Bua Canal and perceived as worthy by key informants interviewed for this research.

10.8 Dimensions of resilience within the buildings and services layer

The quality of buildings and overall degree of disaster risk within the built environment is affected by the potential to access loans at a micro level and planning and reconstruction processes at a macro level, both of which are identified as dimensions of resilience in the buildings and services layer.

10.8.1 Building quality and the politics of participation

In all three case studies lower quality homes were most affected by the flood. In neighbourhoods, housing accounts for the majority of the

typologies of buildings (Arendt and Alesch, 2015). In the Bang Bua Canal, homes that were single storey, built on stilts with wooden flooring and walls were at best heavily damaged by the flood, and at worst completely destroyed. The poor quality of building construction can be traced back to financial vulnerability – inexpensive building materials such as bamboo, corrugated iron and timber were deliberately used to best cope with the weather, offer privacy and accommodate construction on marginalised land, which in this case is the unstable bank of the Bang Bua Canal.

Meanwhile, well constructed two-storey homes that met planning regulations and risk reduction measures, were instrumental in enabling flood survivors to live at home, very often with access to running water and electricity. Other high quality buildings included community and health centres in all three neighbourhoods. The location of community centres heavily influenced their usefulness. In Bang Bua Neighbourhood, a two-storey community centre enabled the neighbourhood to manage flood distributions for its residents from one centralised location. In fact, the high quality of the building, the centrality of the neighbourhood plot within the canal and the efficiency of the governance structure resulted in Bang Bua Neighbourhood becoming a central hub for the Bang Bua Canal Network's activities. In Saphan Mai, the community centre was well built and had two stories but was out of the reach of vehicular access and therefore was not used to manage distributions. Instead, the leader's home was used as a distribution point. In Roi Krong, the community centre and health centre were both single storey buildings that flooded, and were therefore not viable locations to manage the neighbourhood flood response from. Therefore, it can be observed that reducing flood risk in an urban environment is best approached through the construction of higher quality buildings that have multiple stories.

Additionally, access to financial mechanisms that enable poorer people to construct homes of adequate quality is important (Satterthwaite, 2014). Moreover, it is crucial to create space for important economic and social neighbourhood level processes to take place before the actual building process begins (Boonyabancha, 2004). Crucially, savings groups can be established, a new system of governance developed to manage the building process and social capital fostered was through bonding, bridging and linking activities.

However, the process for reconstructing buildings after the flood risks excluding large, fluid populations of renters. While the boundaries for who qualifies to access land and housing loans needed to be drawn somewhere, it is observed that the building process in the Bang Bua Canal included a small number of renters in Bang Bua Neighbourhood and Saphan Mai Neighbourhood, but did not proceed on a large-scale in Roi Krong because room rental was a primary income generation activity with 90-200 rooms available for rent. The Baan Mankong programme requires people to invest in the neighbourhood by committing to 15 year loan payments; it requires collective action; high levels of trust; and governance mechanisms that operate like 'gate keepers' to enforce rules of participation and sometimes exclusion. For instance, a home cannot be bought, sold or willed without prior approval of the committee. Therefore, it can be argued that the current building model's intolerance for the continuation of healthy and vibrant rental markets enforces a rather rural approach to the dynamic, diverse and fluid housing needs of cities.

10.8.2 Inclusive planning and reconstruction processes

Planning policies at a city-scale and neighbourhood scale are the last two dimensions of resilience that greatly influenced the buildings and services layer. A lack of enforcement of planning regulations at a city level resulted in the construction of vulnerable buildings in the Bang Bua Canal.

According to key informant interviews and secondary data, the canal is at risk of a range of climate and non-climate related disasters including increased severity and frequency of flooding, environmental deterioration, political risks and economic shocks. Although national and city scale frameworks and policies exist, it is worth noting that such policies sometimes require contextualisation or adaptation at a neighbourhood scale in order to take into account specific risks in specific areas. For example, flexible planning policies were applied to houses in the Bang Bua Canal that enabled people to legitimately build their homes closer together, waiving on-site sanitation regulations and making an exception to Bangkok's Comprehensive Plan's land-use controls (Usavagovitwong et al., 2013).

Flexibility in the planning process was important and directly contributed to a more effective building process. All the neighbourhoods experienced incremental housing upgrading, which allowed people to join when they felt ready to. For example, Bang Bua Neighbourhood began its upgrading with its leader tearing down his houses and giving away six out of seven of his plots. Saphan Mai started with 65 houses before the process stalemated. However, reconstruction activities recommenced again after the 2011 flood when the disaster became an opportunity to change the social dynamics in the neighbourhood, resulting in the upgrading of 45 more houses. In Roi Krong only 25 houses were reconstructed and 12 repaired since the upgrading began in 2004, but perhaps more houses will join the programme as the context in the neighbourhood changes over time. Importantly, neighbourhoods and individuals have the flexibility to manage the planning process in a way that best suits them.

In summary, analysis of the three case studies at the building layer demonstrates that access to pro-poor financial mechanisms and flexible planning mechanisms and processes at a neighbourhood and city-scale are

dimensions for resilience within the building layer. However, the building layer also illustrates that Baan Mankong's financial mechanisms exclude an important part of the housing market: renters, thereby neglecting to respond to an urban need that housing for poorer urban people must also address.

In summary the dimensions of resilience identified at the four different morphological layers can be summarised in one table as shown below in Table 10.8.2a.

Summary table of the dimensions of resilience in different morphological layers	
Topography	<ul style="list-style-type: none"> • Civil society networks and partnerships that collectively produce and share knowledge • Civil society networks and partnerships that demonstrate a capability for analysis, self-representation and agency • Civil society networks and partnerships that fill the gap where government policies and frameworks are not effective
Movement networks and public open spaces	<ul style="list-style-type: none"> • Safety • Inclusiveness • Income generation
Plots	<ul style="list-style-type: none"> • Land tenure • Financial mechanisms • Governance structures • Social capital
Buildings and services	<ul style="list-style-type: none"> • Building quality and the politics of participation • Inclusive planning and reconstruction processes

Table 10.8.2a: A summary table of the dimensions of resilience in four different morphological layers. Source: the author

Conclusion

Part I of this chapter sought to re-interpret case study findings by revisiting general conclusions from each of the neighbourhoods and identifying key patterns formed by the interaction between economic, governance and social CAS. Those patterns were then plotted on the morphological layer where they had the greatest impact, at which point the intersections between systems and morphology enabled the identification of key dimensions of resilience.

In Bang Bua neighbourhood nine dimensions of resilience were identified with the majority of the dimensions found in the plots layer where the greatest degree of positive transformation took place due to security of land tenure, effective savings groups and governance structures, a strong sense of group agency, high levels of social capital and a thriving welfare structure. The dimensions of resilience identified in the Bang Bua Neighbourhood were mostly positive.

In Saphan Mai neighbourhood eight dimensions were identified, and like in Bang Bua Neighbourhood, most of the dimensions were found in the plots layer, and were mostly positive. Saphan Mai also negotiated security of tenure, had moderate success with its savings group, improved levels of personal safety and developed the ability to self-organise. However, a low-level conflict in the governance structures meant that a minority of people who resisted upgrading were marginalised in the neighbourhood and only part of the neighbourhood 'bounced forward' or transformed physical, economic and social aspects until the flood occurred, at which point all individual in the neighbourhood signed up for upgrading.

However, in Roi Krong neighbourhood only four dimensions of resilience were identified with a mix of positive and negative impact, depending on the who was impacted. Overall, the dimensions of resilience identified

mostly built resilience for affluent holders of power in the neighbourhood, but increased vulnerability for poorer residents. Therefore the dimensions of resilience in Roi Krong were negative for the majority of people. For example, neighbourhood safety has not changed after the minimal upgrading or the flood. Today pedestrian lanes remain poorly lit and are not well connected, so much so that it prevents police officers from entering at night unless accompanied by neighbourhood residents. The resistance to change at the movement networks and public open spaces level has prevented the neighbourhood from seeing positive transformation. Additionally, the same resistance to change can be observed at the building layer where a high number of room rentals are offered by powerful property owners who resist entering a land sharing agreement with poorer individuals.

At the end of the discussion of Part I, a table that summarises the key dimensions of resilience in each case study was presented.

Meanwhile, Part II of this chapter established connections and common themes between the cases by identifying urban resilience dimensions that can be generalised within each morphological layer. The first layer, the topography layer, found networks and external partnerships were important sources of support when government policies and frameworks were ineffective or failed altogether. The second layer, movement networks and public open spaces, found roads and public open spaces were primarily used for social and economic purposes, and that when positive changes occur within this layer it resulted in higher levels of perceived safety, social inclusion and income generation. The third layer, the plots layer, concluded that when development mechanisms were introduced and well-received by a neighbourhood, it was likely that those mechanisms could be adapted during a crisis situation. Securing land tenure was found to be the first step in transforming plots. Lastly, the

buildings and services layer found that access to loans was essential to helping the poor reconstruct robust infrastructure. Moreover, the planning of houses and the reblocking of the plots layer was most successful when it was done inclusively.

In summary, the dimensions of resilience in the case studies reflect many of the principles of development, disaster response, urban design and planning discussed in Chapter One including a participatory process, inclusiveness, engagement with local actors and the importance of accountable systems. The next chapter will explain linkages between the generalisable findings from the case studies and their link to the conceptual framework and broader theories from the literature.

Chapter eleven

Generalisable key findings

Introduction

This chapter aims to identify generalisable and transferrable principles for urban disaster resilience as a concept that exists both in practice and in theory. It uses analysis from multiple cases as a useful method for making comparisons between the cases in order to link practice to a generic body of theory (de Vaus, 2001). The chapter also seeks to evaluate the conceptual framework's generalisability by explaining the ways in which urban stakeholders from academia and practice validated it. This chapter is structured in three sections.

Section 11.1 seeks to identify generalisable conclusions about the case studies and their link to the conceptual framework. The aim of section 11.1 is to explain key practical lessons that arise as a result of combining CAS and morphological approaches that have the potential to assist neighbourhoods and urban professionals to operationalise resilience.

Section 11.2 seeks to establish connections between the conceptual framework and general body of theory. Here, four generalised key

findings regarding the validity of the conceptual framework are identified. The chapter then demonstrates the generalisability of those findings by making connections between the conceptual framework and theories raised in the literature review in Chapter One. A refined definition of resilience is then proposed based on the revised conceptual framework.

Section 11.3 is an evaluation of the conceptual framework. The process for validating the framework and accompanying analytical tool is described. The process of refining the conceptual framework and analytical tool is then explained followed by a description of their strengths and limitations. Table 11.0 below summarises the three sections of this chapter.

Structure of chapter eleven		
Section 11.1	Establishes connections between the case studies and the conceptual framework	Generalisable conclusions about the connections between dimensions of urban disaster resilience in the case studies and the conceptual framework are identified for practical application in other contexts.
Section 11.2	Establishes connections between the conceptual framework and general bodies of theory	Generalisable conclusions about the conceptual framework are made in relation to general bodies of theory. A refined definition of resilience is proposed.
Section 11.3	Evaluates the conceptual framework and accompanying analytical tool	The process for validating the conceptual framework and analytical tool is described and reflected upon.

Table 11.0: Provides a summary of the structure used to establish connections between theory and practice in Chapter 11. Source: the author

11.1 Connections between resilience dimensions and the conceptual framework

This section interrogates the dimensions of resilience identified in the three case studies in order to understand what can be generalised beyond this particular study (de Vaus, 2001), especially in regards to practice.

When the key dimensions of resilience identified in the previous chapter are plotted on the conceptual framework, three generalisations can be made that apply to this study and beyond specifically regarding a.) social CAS; b.) the plots layer; and c.) the rate of change within the built and natural environment with regards to disaster recovery. Figure 11.1 below is an illustration of the conceptual framework with key dimensions of resilience identified in Chapter Ten (Part II) plotted at the intersections between CAS and morphology. The dimensions were identified through a cross-case analysis.

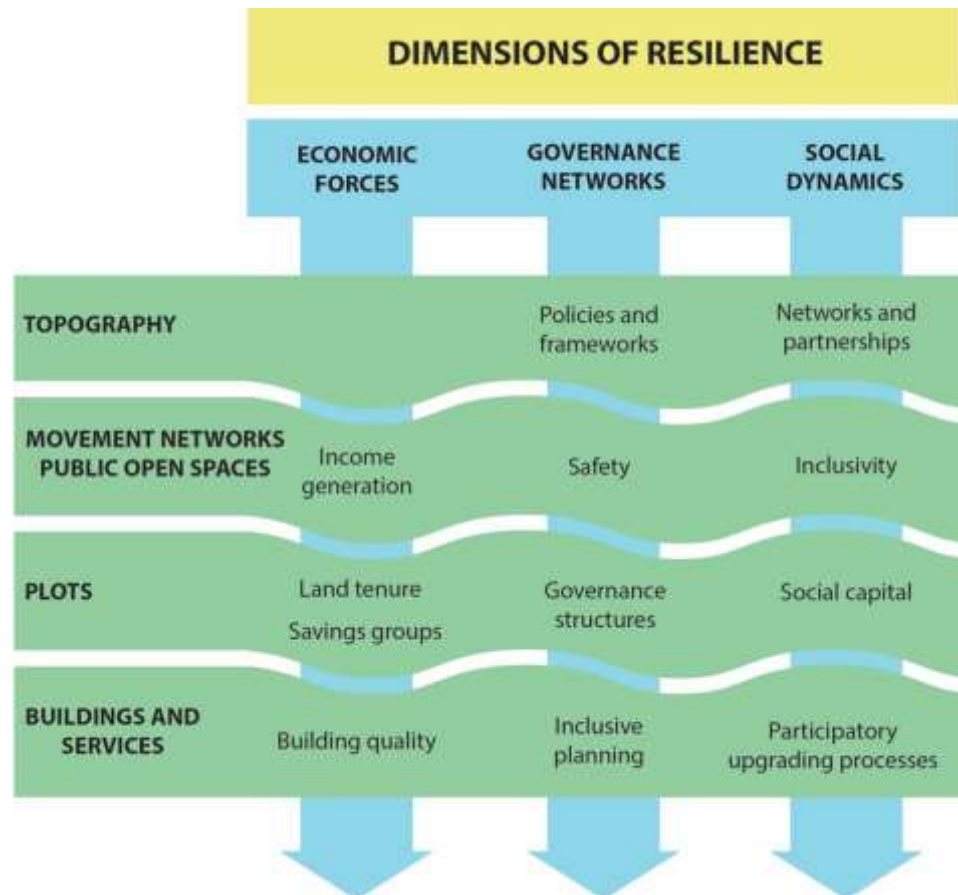


Figure 11.1: the conceptual framework with key dimensions of resilience plotted at the intersections between CAS and morphology. The dimensions were identified in Chapter Ten through a cross-case analysis. Source: the author

a.) Social dynamics are the most influential complex adaptive system

As show in Figure 11.1a above, social dynamics played an important role in influencing the built and natural environment at every morphological layer where formal policies, procedures or frameworks failed to support poorer people. In the absence of money, collective social dynamics or ‘collectivism’ works as a kind of social wealth (Boonyabancha, Carcellar and Kerr, 2012). This section describes the role of social dynamics and their influence at four different morphological layers.

Topography layer

At the topographical layer civil society networks and partnerships became strong and responsive to local needs when disaster management

policies and frameworks were ineffective. For example, disaster management policies failed to prevent the 2011 flood from reaching Bangkok, and later from reducing the flood's impact (discussed in Chapter Six and Chapter Ten). Johnson and Blackburn write that cities have the responsibility to see themselves as part of a 'global network to reduce disaster risk reduction' (2014, p.29). Reducing disaster risk aligns with governmental mandates to protect citizens.

Movement networks and public open spaces layer

At the movement networks and public open spaces layer new roads and public open spaces gave neighbourhoods increased channels for socialising and improving their income generating opportunities by increasing the permeability of the roads within the neighbourhoods, and by creating inclusive, safe spaces for people of different age groups and demographics to socialise in. Jacobs (1961a) notes that successful city neighbourhoods make safety an asset through clear demarcation of public and private space and a high level of footfall and visual monitoring by the proprietors of the street. In a disaster the protection of vulnerable groups such as women, children, the elderly and PLWD amongst others is often achieved through safe roads and public spaces such as child friendly spaces (Phongnonsung and Borchard, 2012) and community centres where information can be shared.

Plots layer

At the plots layer, the higher the level of social capital in terms of trust and ability to work collectively towards a goal, the better the financial and governance mechanisms were able to fulfill their functions. This aligns with de Soto's (2000) theory that the poor often have access to the assets they need, but because they are held in defective forms, the assets do not advance them. At times of stress or shock, retreating into small groups to share social and economic forms of support enhances

coping mechanisms and minimises risk to the group members (Pelling, 2003). In the Bang Bua Canal, the actions taken at the plot layer helped to build social capital and minimize the risk through collective action. However, access to secure land tenure (Tarbatt, 2012) and loans through savings groups (Jabeen, Allen and Johnson, 2010) is also important for building disaster resilience. In the Bang Bua Canal secure land tenure made it more likely that individuals viewed investments in financial and governance mechanisms as low-risk because of their right to access the land. Loans were also an essential resource for developing high quality buildings and obtaining access to adequate services (Boonyabancha, 2005). Moreover, they were important ways for the poor to juggle complex financial portfolios (Moser, 2008) that balance long-term investments in things such as disaster resistant housing versus short-term needs such as food and school fees. Lastly, resilience at the plots layer raised important governance questions, namely who should be resilient and to what (Lebel et al., 2006).

Building and services layer

At the building layer, inclusive and participatory upgrading processes developed the resilience of the social fabric alongside the physical components of buildings. De Soto writes that buildings used to lead an 'invisible parallel life alongside their material existence' implying that a lack of legal right to access land resulted in buildings that were unable to be turned into capital connected within the broader formalised economy (de Soto, 2000, p.7). Thus, it is here where links between the morphological layers and social processes become especially important. In many ways dimensions of resilience from the plots layer influenced activities at the building layer. For example, collective social action achieved access to land at the plots layer in order to proceed with building construction and improvement of services. Furthermore governance structures and savings groups from the plots layer enabled

the reconstruction of homes and neighbourhood buildings through access to affordable loans. Such loans were only available to people who formed strong social ties and worked together.

Meanwhile, flexible building and planning policies that are designed to include poorer urban people have been shown to increase coping mechanisms for individuals, households and neighbourhoods (Wamsler and Brink, 2014). At the building layer it became apparent that policies could only be changed by urban actors such as planners who needed to be involved in the amendment of housing policies and regulations where necessary (Usavagovitwong et al., 2013). Through partnerships with technical experts, people from the Bang Bua Canal upgraded in ways that improved the robustness of the buildings and access to public services and utilities for the entire neighbourhood. Overall, inclusive planning can provide a level playing field for stakeholders, strengthening transparency and accountability (Habitat III, 2015h).

The dimensions of resilience related to social CAS are highlighted in Figure 11.1b. The presence of social dimensions of resilience at every layer suggests that social dynamics is an important CAS for poorer urban people, and with the support of theory, is identified as generalisable beyond this case study.

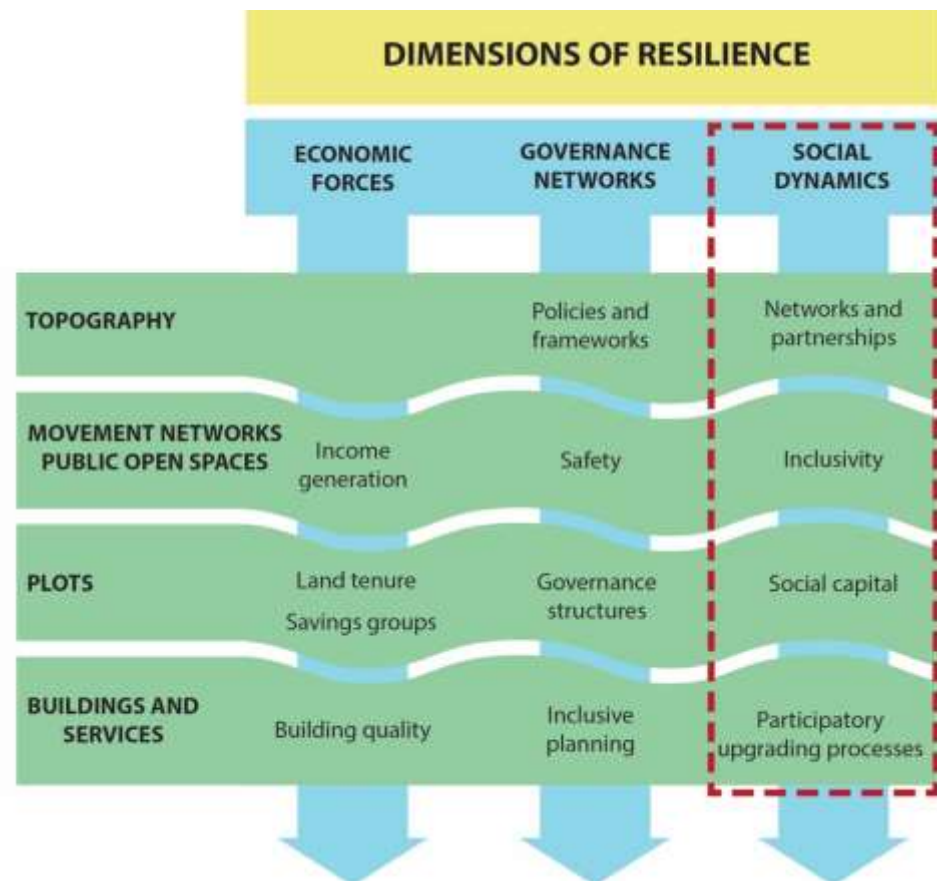


Figure 11.1a: The conceptual framework with key dimensions of resilience plotted on it. Social dynamics were identified as influential at every morphological layer, therefore suggesting that social dynamics an important CAS for poorer urban people. Source: the author

b.) *The plots layer: the most influential morphological layer*

The plots layer demonstrated that multi-sectoral investment in neighbourhood scale complex adaptive systems could result in a more holistic, collaborative approach for building resilience to chronic stresses and disaster shocks. Feedback loops (Holling, 2001) exist between financial mechanisms, governance mechanisms and social capital with each one influencing the other. The emphasis on multi-sectoral stakeholders draws from the research findings and theory that urban risk is often 'created or exacerbated by local government's incapacity to act in the public good, guide urban growth and ensure infrastructure and service provision' (Dodman et al., 2013, p.26). A systems approach to resilience provides an emphasis on complexity and cross-sectoral

collaboration (Bahadur and Tanner, 2014), which arguably made investments at the plots layer sustainable.

The four dimensions of resilience – savings groups, land tenure, governance structures and social capital – identified at the plots layer reflect a multi-sectoral approach to resilience that is also found in development and disaster literature. For instance, Boonyabancha (2009) writes that collective land ownership is key to transitioning neighbourhoods from informal to formal, which in turn provides protection against eviction and market forces that drive poorer people to sell. Moreover, the collective ownership of land encourages collective responses to problems. Meanwhile, savings groups are noted by Satterthwaite (2014) to work well when there is trust between people and accountable governance systems, which is most readily seen at the plots layer in the Bang Bua Canal. In terms of government structures, broader theories within development and geography observe that governance works best when it is transparent, accountable, shares power, is inclusive in decision-making processes and just (Allen, 2003; Siisiainen, 2000). Finally, Archer (2009) writes that social capital increases through collective action against threats such as eviction or disaster shocks (such as a flood).

Moreover, actions taken at other morphological layers also affected the success of investments at the plots layer. The learning and sharing of knowledge (Reed et al., 2014) that results from civil society networks and partnerships can benefit an entire neighbourhood. Likewise, flexible planning policies that can be adjusted to suit specific neighbourhood contexts can also ensure successful sharing of land at the plots layer. Access to loans that factor social security funding into interest rates can be of great benefit to some of the poorest people in the neighbourhood (Satterthwaite, 2014).

The interaction between the plot and the three other layers enabled input from different actors such as: the local district government, city planners, the loan lender, the land lessee and planners assisting with re-blocking of plots and reaching land sharing arrangements. Development strategies and tools tend to label such collaborative multi-stakeholder interactions as Area Development Approaches (ABAs), currently coming back into fashion in the humanitarian sector (Parker and Maynard, 2015). Figure 11.1c below shows four dimensions of resilience at the plot layer: secure land tenure, financial mechanism, governance mechanisms and social agency. The dimensions spread across all three CAS highlighting that multi-sectoral investment at the plots layer has a high influence on resilience.

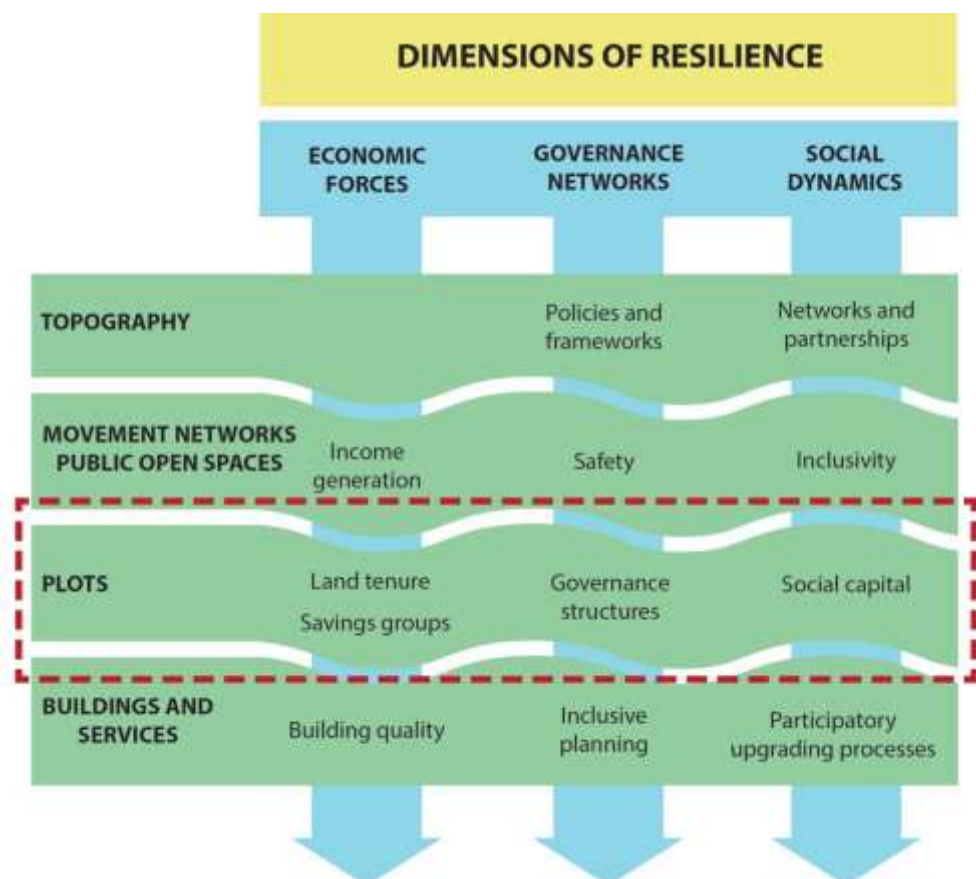


Figure 11.1b: Four dimensions of resilience are identified at the plot layer: secure land tenure, financial mechanism, governance mechanisms and social agency. Source: the author

c.) The rate of change that occurs within each layer and disaster recovery time

The third connection between the cases and the conceptual framework is that the rate of change that occurs within each layer impacts recovery time after a disaster. Evidence from the case studies and general body of theory suggests that the fastest rate of change occurs at the building layer (Bolio Arceo, 2012; Whitehand, 1987; Moudon, 1997) and the slowest occurs at the topography layer (Bolio Arceo, 2012; Moudon, 1997). It can be helpful to urban actors to understand the rate of change in the built environment, especially after a disaster in order to develop appropriate recovery timelines and funding for each morphological layer of the city.

The topography layer of the conceptual framework has traced changes in land and water over hundreds of years. The topography layer is useful for long-term forecasting and planning policies on how to sustainably manage land and water by national governments. For example, Thailand submitted its first National Communication report to the United Nations Framework Convention on Climate Change (UNFCCC) in 2000 where it highlighted adaptation priorities for agriculture, water management and coastal regions (Gass, Hove and Parry, 2011). In its Second National Communication in 2011, it highlighted progress, changes and constraints, and reaffirmed that climate variability and extreme weather events are Thailand's greatest challenges (Gass, Hove and Parry, 2011). Other key policies that came up at the topography layer include progress reports and commitments to the MDGs (Inter-Agency and Expert Group on MDG Indicators, 2015; United Nations Development Group, 2014) , which have ended and are now the SDGs (United Nations, 2015b) and the Hyogo Framework (UNISDR, 2005b), which has also ended and has been replaced with the Sendai Framework for Disaster Risk Reduction 2015-2030, adopted in March 2015 in Sendai, Japan (UNISDR, 2015c). However, the formation of policies alone cannot protect the topography

layer from negative changes. As was seen in the Bangkok flood case study, when policies are not effective or enforced, negative consequences can occur. Other aspects that compliment policy are important, too, such as financial investment in infrastructure in order to manage long-term infrastructure risks as well as investment in civil society and social development.

The movement networks and public open spaces layer sees an increase in pace of change slightly, but transformation still occurs in this layer rather slowly and in incremental stages. A comparison between movement networks around the Bang Bua Canal in 1968 and today (as demonstrated in Chapter Five) reveals that major roads and streets have remained relatively the same. Smaller scale roads and alleyways change much more quickly as was reflected in the individual neighbourhood case studies. Likewise, large, public open spaces such as temple and university gardens around the Bang Bua Canal have largely maintained the same shape and size they held in 1968 as they are today (as discussed in Chapter Five).

The plots layer changed rather quickly in the three case studies presented. In Bang Bua neighbourhood the plots changed almost as fast as the building layer. Nevertheless, changes to plots can also move rather slowly as it did in Saphan Mai Neighborhood where the plots layer saw transformation take place over a 14-year period of time. Furthermore, in the case of Roi Krong neighbourhood the plots have seen even slower rates of change where the majority of the neighbourhood plots resist any change at all. In summary, the large surface area of a neighbourhood encompasses more decision makers to negotiate outcomes within a larger area of land, and therefore changes often occur more quickly at the plots layer than the topography layer and the movement networks and public opens spaces layer. This research suggests that urban disaster

recovery professionals should consider the benefits of investing in land tenure, financial and governance mechanisms alongside social capital before they design interventions, particularly for aid agencies taking an area-based approach.

The buildings and services layer is the smallest scale and therefore the easiest of all the layers to modify. Under the right financial conditions buildings can be modified or reconstructed, regardless of legal access to land. For humanitarians this means that buildings are one of the easiest layers to intervene in, especially because the outcome is concrete and tangible, therefore, arguably more appealing to donors than intervening in 'soft' areas such as financial or governance mechanisms observed at the plot layer. However, this research demonstrates that interventions in buildings alone do not improve the resilience of a neighbourhood. Investment is also required in social, economic and governance aspects of neighbourhood living.

11.2 Connections between the conceptual framework and theory

This section reflects on the conceptual framework and existing bodies of theory, seeking to demonstrate that the new framework is sound, valid and provides a logical way of interrogating disaster resilience. Five key generalisable conclusions are drawn that suggest the confluence of morphology and systems approaches can in fact be combined as a new conceptual framework for understanding urban disaster resilience.

a.) A people-centred approach

Perhaps most importantly, this conceptual framework puts people at the centre of building urban disaster resilience. It prevents actors from making the assumption that interventions in the built or natural

environment alone will improve urban disaster resilience. Instead, the framework highlights the ways in which the built form interacts with three complex adaptive systems – economic, governance and social. For example, an intervention at the building layer of the framework illustrates that constructing a building has economic, governance and social implications. Conversely, it also shows the importance of a quality built environment and the ways in which the built environment affects people's lives.

b.) Simultaneous analysis of disaster and development risks

The literature review in Chapter One suggested that risk is often analysed in silos: humanitarians approach analysis from a disasters perspective while development practitioners view risk from a development perspective (Collins, 2009). This conceptual framework analyses disaster and development risk together, recognising that the separation of types of risk – chronic versus disaster – is largely an academic exercise, and that in reality people from low-income neighbourhoods do not separate the two (Bene, 2013). Therefore, when analysing urban disaster resilience it is imperative everyday risks and disaster risks are considered together.

c.) Scalar and temporal analysis

Using morphology to interpret the qualities of human interaction with a city's urban fabric allows a flexible approach for analysing different scales of the built and natural environment (Moudon, 1997). Meanwhile, a systems approach that analyses access to power and the distribution of resources at a range of scales is crucial for understanding factors internal and external to the scale of analysis (Tyler and Moench, 2012).

However, because the quality of human interaction within a city's urban fabric is always evolving, it is important to be able to take a snapshot in

time in order to have a 'baseline survey' of vulnerability, risk, capacity and dimensions of resilience at a specific point in time in order to compare states of existence across time (Walker et al., 2004). For example, a snapshot could be taken before, during and after a disaster, in order to assess the state of power, equity and quality of life. A snapshot in time is a helpful way to determine changes that have taken place and the primary dimensions responsible for the change. Morphology and CAS approaches analyse links with history, which are often reflected in the present structure of a system (Juarrero, 2000), suggesting morphology and CAS are useful approaches to analyse scale and time.

d.) Using intersections between morphological layers and CAS to identify dimensions of resilience

The conceptual framework seeks to demonstrate that intersections between CAS and morphology identify dimensions of resilience at a range of scales across disaster and development contexts. The intersections between the built and natural environment and the CAS systems are where dimensions emerge as key influencers of change. Resilience dimensions are identified through interrogating complex interactions between CAS and morphology by deconstructing complicated feedback loops (Juarrero, 2000) with fuzzy boundaries (Bar-Yam, 1997b) about where interactions begin and end and analysing seemingly chaotic and non-linear patterns of behavior that have inter and intra-dependent causal relationships (Wallace and Wallace, 2008). Analysis of feedback loops provides the opportunity to draw conclusions about the basins of attraction (Walker et al., 2004) at each morphological layer; much like humanitarian aid workers strive to develop a baseline survey of key elements of an environment. The basins of attraction are useful because they allow qualitative judgments about the overall state of a neighbourhood to be made. The basin of attraction may need to be

altered to reduce risk and build resilience; or, it may have reached a threshold that requires transformation (Pelling and Manuel-Navarrete, 2011) because it holds high levels of risk or a transfer of power is taking place. In order to interpret what the feedback loops in the conceptual framework tell us, we must first clearly define resilience for *whom* and to *what*.

Furthermore, the intersections in the conceptual framework assist to identify issues for intervention at different morphological layers from an economic, governance and social perspective. Identifying key issues at a particular morphological layer has the potential to assist with the identification of appropriate actors to collaborate on the issue, be it at a practical level or through policy-based work. Such actors can include urban planners and designers, architects, politicians, governments (district, city and national levels), the private sector, universities, emergency personnel (police, fire and ambulance), the army and aid agencies.

e.) Resilience is built before and after a disaster

Dimensions of risk are created through human design (Arendt and Alesch, 2015) and therefore can be countered through a lens that considers how humans interact with the designs of built form and natural environments that host the built form.

Before a disaster

It is worth recapping that vulnerability in cities and towns arises when people have limited access to income and employment; inhabit inadequate and insecure homes on insecure land; are unable to access adequate infrastructure and services; are at risk of natural hazards or environmental health risks; have limited mobility or access to transportation or face discrimination due to issues of exclusion (Moser,

2008). It is therefore important to mitigate these chronic and disaster risks and to prepare for uncertain events that might surprise us (Boin, Comfort and Demchak, 2010). Essentially, it is crucial to build a fail-safe environment (Jha, Bloch and Lamond, 2012). In other words, it is important to create an environment that is able to fail safely by maintaining its basic functions without causing the entire system, be it a neighbourhood or a city, for example, to collapse. Therefore, this research concludes that building resilience takes place *before* a disaster occurs as is indicated in Figure 10.5.2a where arrows along the four morphological layers indicate activities before a disaster.

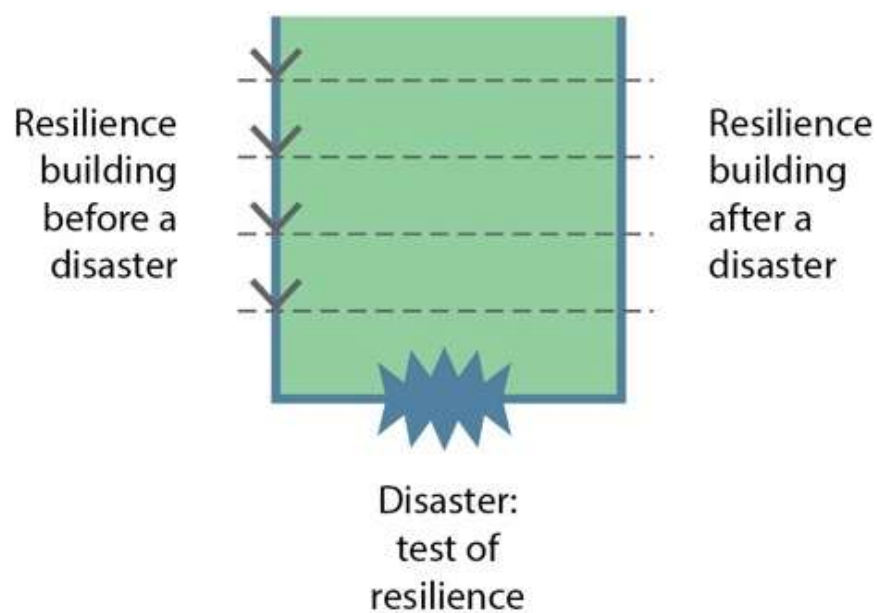


Figure 11.2e: An illustration demonstrating that resilience building occurs *before* a disaster strikes as indicated by the arrows on the left. The dotted lines in the graphic illustrate the four morphological layers where resilience building takes place. The middle section indicates that the disaster event serves as a test of resilience. Source: the author

The disaster event

The disaster event tests the ways in which CAS and their components adapt to maintain basic function without causing the whole system to fail. Essentially, the scale of resilience under interrogation – be it a

household, a neighbourhood, or a city, for example – is considered resilient if there is little difference between pre and post shock states of affair (Alfani et al., 2015). As analysis of CAS in this research has shown, there are many ways components of a system adapt to shocks and stresses, depending on the system and morphological layer under examination. Some examples may include networks and how they adapt mechanisms for managing information, coordinating needs assessment and cooperating to distribute supplies at the topography layer.

At the movements and open public spaces layer mechanisms for transportation may adapt from pedestrian or motorized access to boats, as seen in the 2011 Bangkok flood. The importance of public open spaces during a disaster may change from very important to not at all important. For example, during the 2011 Bangkok flood public open spaces were submerged and therefore not important. However, immediately after an earthquake public open spaces may become important places for sheltering people whose homes have been damaged or destroyed.

At the plots layer adaptation may include the ways in which financial mechanisms such as savings groups support member needs during and after the flood. The plots layer may also give consideration to governance systems and how they adapt to support needs during a crisis in terms of who they include in decision-making, how decentralised management structures are and the ways in which they demonstrate accountability.

At the building layer the ways in which use of community buildings is adapted is also a test of resilience – are the most vulnerable protected by having access to adequate shelter and services? It is worth noting that

the concept of adaptation within systems is the reason great value is placed on complex *adaptive* systems (Levine, 1998).

After a disaster

The disaster will have exposed weaknesses and strengths, vulnerabilities and capacities that when analysed through a CAS and morphological framework will identify dimensions of resilience at different scales. The disaster will highlight development mechanisms that worked effectively and those that did not, providing an opportunity to build back better in the truest sense, if analysis is carried out before and after the disaster to draw a comparison during the post-disaster recovery phase. Figure 10.5.2b below is an illustration demonstrating that resilience building occurs before a disaster strikes and again during recovery from a disaster. The disaster event in essence serves as a test of resilience.

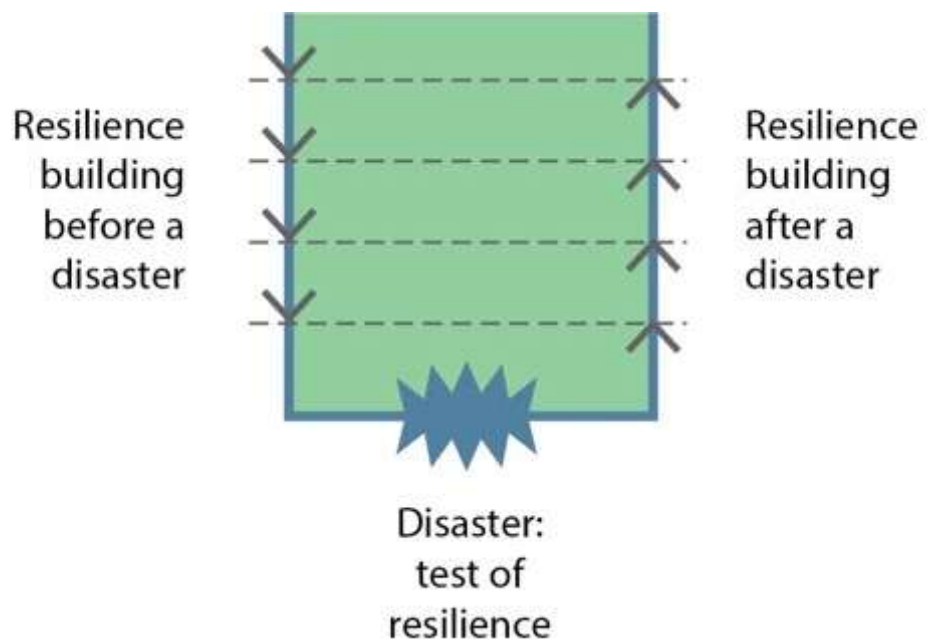


Figure 11.2f: An illustration demonstrating that resilience building occurs *before* a disaster strikes and again *after* the disaster as indicated by the arrows on the right and left. The dotted lines in the graphic illustrate the four morphological layers where resilience building takes place. The middle section shows that the disaster event serves as a test of resilience. Source: the author

11.3 Evaluation of the conceptual framework and analytical tool

This section describes the process of validating the analytical tool (introduced in Chapter Four) and the conceptual framework (introduced in Chapter Three). It begins with an explanation of the analytical tool then discusses the process of validating the framework and tool, key refinements that were made as well as identified strengths and limitations. Figure 11.3a below is an illustration of the conceptual framework and Figure 11.3b depicts the corresponding analytical tool under discussion in this section.

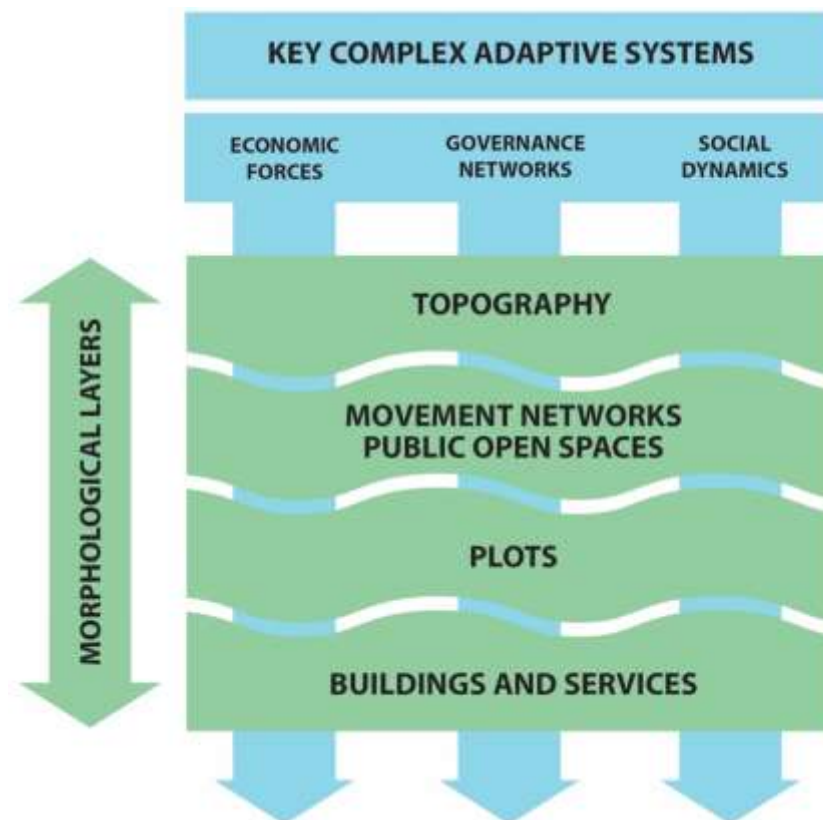


Figure 11.3a: A conceptual framework that blends CAS and morphological approaches into a single framework for interrogating urban disaster resilience. Source: the author

11.3.1 Analytical tool

As introduced in Chapter Three, and subsequently used as the basis for analysis in the case studies, the analytical tool has been devised to translate the conceptual framework into practice. This urban derived tool is a matrix that can be used in disaster management practice by populating it with information before or after a disaster at a neighbourhood, city or national scale. This tool has particular utility because it employs urban approaches that analyse disaster and development risk simultaneously at different periods of time.

The names in the tool are as jargon free as possible in order to allow people with a range of backgrounds to use it with ease. The names of the complex adaptive systems are presented in the top of the matrix alongside a brief description that translates the title. For example, the economic CAS heading 'economic forces' is described as 'things that provide economic benefit such as money, markets, businesses, rent, jobs, savings, loans, credit, ownership and skills', giving a number of examples for the practitioner. The morphological layers presented on the left side of the matrix also have short descriptions. For example, the 'plots' layer is described as a 'parcel of land'.

Uses of the analytical tool

The tool translates theory into practice by allowing the practitioner to document patterns formed by CAS and plot them on the morphological layer where the greatest amount of impact is seen. If significant CAS patterns form within multiple layers, then it is appropriate to record them at each layer. The intersections between CAS and morphology can be viewed as dimensions of resilience. Further analysis of power is required in order to understand if those dimensions are positive or negative by analysing resilience for whom and to what.

This tool provides an opportunity to undertake context analysis and pre- and post-disaster assessments. The matrix format reflects Anderson and Woodrow’s (1998) classic capacity and vulnerability assessment tool in that it creates simple categories for the user to populate information into. The tool can also be paired with the SWOT (strengths, weaknesses, opportunities and threats) analysis methodology as shown in Table 11.3.1a below. The same information can be added to as many boxes as necessary, recognising that reality is complex and the physical and natural layers overlap with various systems.

Urban Disaster Resilience: An Analytical Tool			
Morphological Layers (Built and natural environment)	Interdependent Complex Adaptive Systems		
	Economic Forces Provides economic benefits, such as money, markets, businesses, rent, jobs, savings, loans, credit, investments, skills	Governance Networks Involve the organisation of power and decision-making from local, to national levels, such as governments, institutions, leaders, networks, planning policies and legal frameworks.	Social Dynamics Include social interaction, such as networks, social capital, discrimination, culture and values. It also includes social services such as education, welfare, and healthcare.
Topography Historical and recent changes in use of lands, rivers, lakes and other ecological aspects.	Strengths	Weaknesses	
Roads and Public Open Spaces Changes in access to and quality of roads and public spaces, including paths, playgrounds, parks and market squares.	Opportunities	Threats	
Plots Changes in access to and quality of a defined piece of land and its use.			
Buildings and Services Changes in access to and quality of homes, community centers, shops, electricity, water and sewage.			

Table 11.3.1a: The urban disaster resilience analytical tool paired with SWOT analysis methodology. Source: the author

11.3.2 Validation of the conceptual framework and analytical tool

The purpose of validating the conceptual framework and analytical tool was to identify generalisable aspects of both framework and tool beyond this research. The validation process took place with 69 participants from 15 countries. Participants were from two universities and one aid agency. The first workshop occurred at the Norwegian University of Science and Technology (NTNU) with 14 participants; the second at the British Red

Cross (BRC) with 27 participants; and the third at the Centre for Development and Emergency Practice (CENDEP) at Oxford Brookes University (OBU) with 28 participants. Comments from the three workshops will be annotated in this chapter according to the institution the participant came from, for example CENDEP, NTNU and BRC. The university participants included students from Masters and PhD programmes as well as professors from the disciplines of development and humanitarian aid, urban planning and design, urban ecological planning, geography, architecture and real estate and construction. Participants from the British Red Cross were from 13 sub-sections of the international development department, many of them from regional desks (Asia, Africa etc.) and sectoral areas (health and care, accountability etc.).

To validate the generalisability of the conceptual framework and analytical tool with the university participants, students were asked to apply the urban disaster resilience framework to their research. As part of ongoing academic work, Masters and PhD students from both of the university groups were conducting research on a total of 15 different case studies, 13 of which were linked to a development or disaster themes. A presentation of the conceptual framework was given and then the university students were asked to apply the conceptual framework and analytical tool to their case studies. The most relevant case studies included urban violence, earthquake, cyclone, flood, fire, refugees and internally displaced persons (IDPs), and conflict.

Meanwhile, the generalisability of the conceptual framework and analytical tool were validated with the British Red Cross through a seminar and discussion. All of the BRC participants were working on live development and disaster projects and were asked to discuss the transferability of the framework and tool to their own projects.

11.3.3 Refinements to the conceptual framework resulting from the validation process

The definitions of the CAS systems and morphological layers were refined and nuanced based on discussions with the participants. For example, groups at NTNU suggested giving more examples in each of the morphological layers for those who are less familiar with urban morphology classifications. Participants from all three institutions suggested adding an ecological, environmental or natural category to accommodate factors like climate change or natural hazards such as earthquakes. While environmental change is already accounted for in the topography layer, further emphasis of this fact was added by retrofitting the definition of the vertical axis on the analytical framework to say 'built and natural environment'. Participants from CENDEP reflected that many low-income countries do not use the term 'plots' and would better understand the analytical framework if the plots layer was titled 'a parcel of land', and thus the colloquial language was introduced into the analytical tool.

11.3.4 Strengths

The participants felt the conceptual framework and analytical tool had a number of strengths, including its usefulness for context analysis, its holistic approach and its adaptability to other contexts. Figure 11.3.4a is a sample of the comments from participants at NTNU regarding the overall usefulness of the framework and tool.

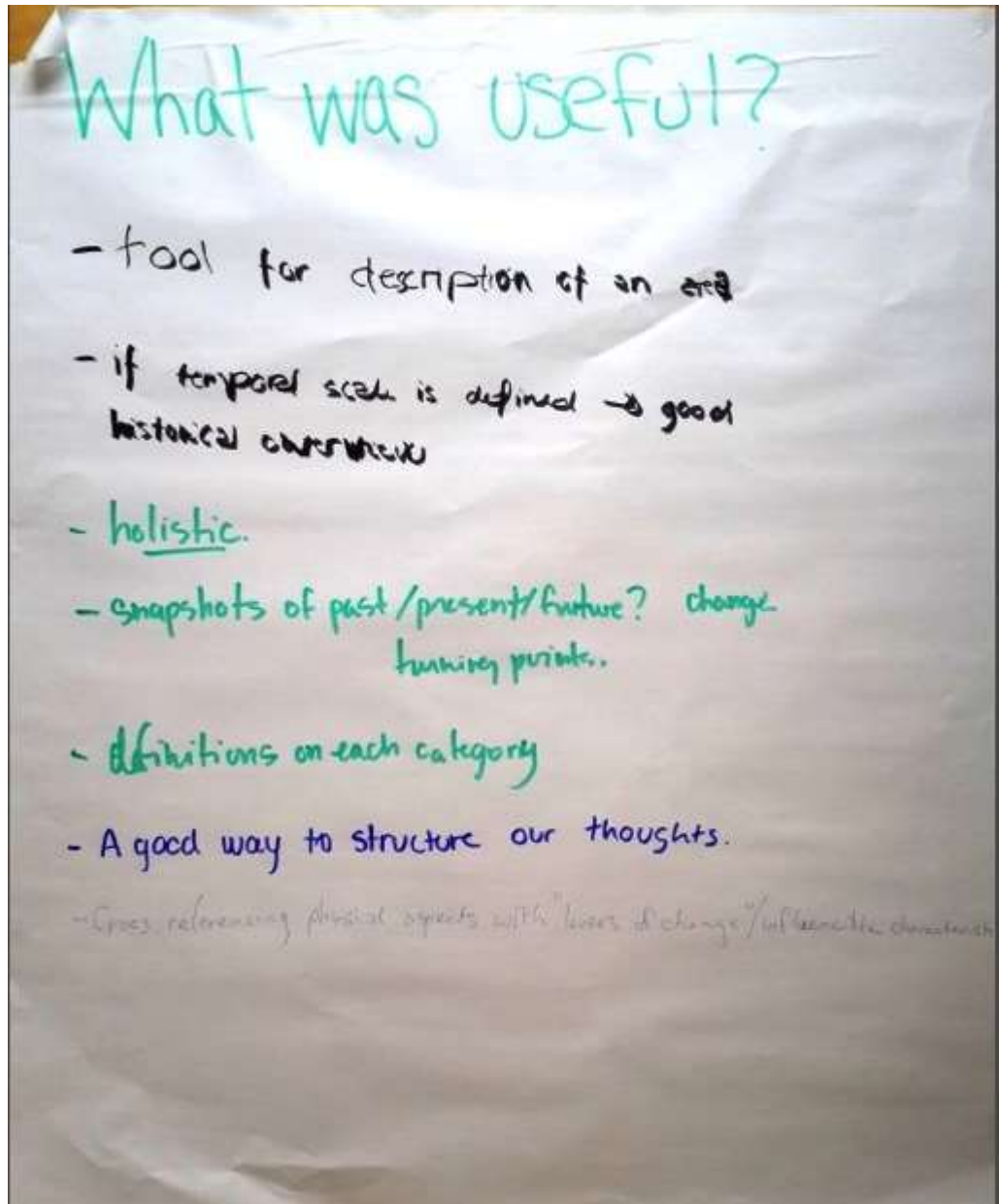


Figure 11.3.4a: A sample of the comments from participants at NTNU regarding the usefulness of the conceptual framework and analytical tool. Source: the author

Useful for context analysis

In response to a question about the usefulness of the framework and tool, participants from all three groups felt both were useful for conducting a context analysis (CENDEP, NTNU, BRC). One participant from the British Red Cross said it was a 'helpful framework that captures a snapshot of a city in time'. Another BRC aid worker said, 'this helps with asking the right questions when you do context analysis'. A discussion within BRC was

then held between participants who suggested the framework could be used to do a vulnerability and capacity and SWOT analysis. One BRC participant who was working on a slum-upgrading project in post-earthquake Port au Prince, Haiti, felt the tool could be used for monitoring and evaluation by using project indicators.

'Holistic' and 'comprehensive'

Participants from the university groups reflected that the conceptual framework and analytical tool were useful because they were 'holistic' and 'comprehensive', drawing links between the past and present (NTNU, CENDEP). One group said that cross-referencing physical and natural aspects with economic, governance and social systems was helpful in identifying 'levers of change' (NTNU). Another said that the focus on the physical changes of an area was a helpful way to understand an urban context, and how the social, economic and political CAS interact (NTNU). Some of the participants from CENDEP felt a broad range of urban actors such as neighbourhood residents, planners, architects, engineers and aid workers, could use the tool. They also suggested that the tool could be a useful basis for area-based programming (CENDEP).

Easily adaptable to other contexts and case studies

While initially developed to be used in low-income countries, specifically in low-income urban neighbourhoods vulnerable to flooding, three rounds of validating with participants has identified that by adapting some of the categories, the framework is applicable to a wider range of urban contexts and hazards – from urban violence to IDP movements to natural hazards. Nearly all of the student participants were able to populate the tool with information from their case studies (CENDEP, NTNU), except for the case study on bicycle land planning (NTNU). For example, in a Nigerian case study on IDPs (CENDEP), it was felt that the topography layer could include natural resources such as oil and gas in its definition.

One group that was working on a case study of slums in Addis Ababa, Ethiopia said analysis of the physical aspects in relation to key systems was helpful in understanding how slums came about (NTNU). In a BRC project on conflict in South Sudan, ethnicity is a big driver of risk and resilience in urban spaces, and British Red Cross aid worker, therefore suggested the inclusion of ethnicity in the definition of social dynamics. Another participant from BRC said the conceptual framework and analytical tool reflected ‘exactly what we are working on’ in Port au Prince after the earthquake. The following vignette expresses the transferability in the words of a British Red Cross aid worker:

“We are finishing off our programme in Haiti. We did a lot of response and recovery work early on after the disaster, but then we focused on a community that is more of a slum environment in Port au Prince.

“It’s been really interesting to see how the combination of all these points you say can really maximize resilience moving forward. The community where we work in used to flood yearly. It was surrounded by a canal that was a couple of meters wide. There were 4000 people living there. There was no sewerage clearing. There was no rubbish collection.... The flooding would come up to waist level, so people would stop working and going to school. There were really high levels of cholera and other diseases. It is very dense so safety was very poor with a lot of drug issues and crime.

“We paved over the canal, which stopped the flooding and then we put in drainage so when it does flood the water drains off. This is all with the community’s input. It took nine months before we did anything because we were working with the community to find out what their problems were because it’s not always apparent what problems they suffer. If you visit them outside of the rainy season you might not see the impact of flooding or cholera. But then throughout the year you see massive change.

“What you’ve presented is exactly what we are working on. It’s nice to see.”

Figure 11.3.4b: A vignette from a British Red Cross aid worker about the transferability of the conceptual framework. Source: FGD BRC

11.3.5 Limitations

There were several limitations with the framework that have been addressed. One person from BRC asked where the disaster event is reflected in the conceptual framework. After some discussion it was concluded that the framework is best used before or after a disaster because it captures risk, capacity, vulnerability, threats and opportunities at a specific point in time, but does not focus on assessment of basic needs (food, water, shelter), which is essential information for humanitarians focused on saving lives in a disaster (BRC).

One group said their lack of historical knowledge about their case study on Haiti made it difficult to populate the matrix because they did not have enough information immediately at hand (NTNU). All three workshops had one person who felt the box format of the tool was problematic because it restricted thinking into linear categories and does not adequately show the overlaps that occur (CENDEP, NTNU, BRC). This concern is addressed by referring to the conceptual framework, which serves as a visual reminder that CAS are interdependent. Finally, one person from CENDEP felt that the tool would be more helpful if it was three dimensional to more accurately represent the time continuum. This limitation was not able to be addressed within the present format of the conceptual framework and analytical tool. Figure 11.3.5a below gives a sample of the comments from NTNU participants indicating what could be strengthened in the conceptual framework and analytical tool.

Figure 11.3.5b below is a sample of the analytical tool applied to a case study of the 2010 Haiti earthquake by students from NTNU. Arrows are drawn in the boxes to show linkages between the morphological layers and CAS. The Figure shows the morphological layers described only as physical at the time of validating. They have since been changed and described as 'layers of the built and natural environment'.

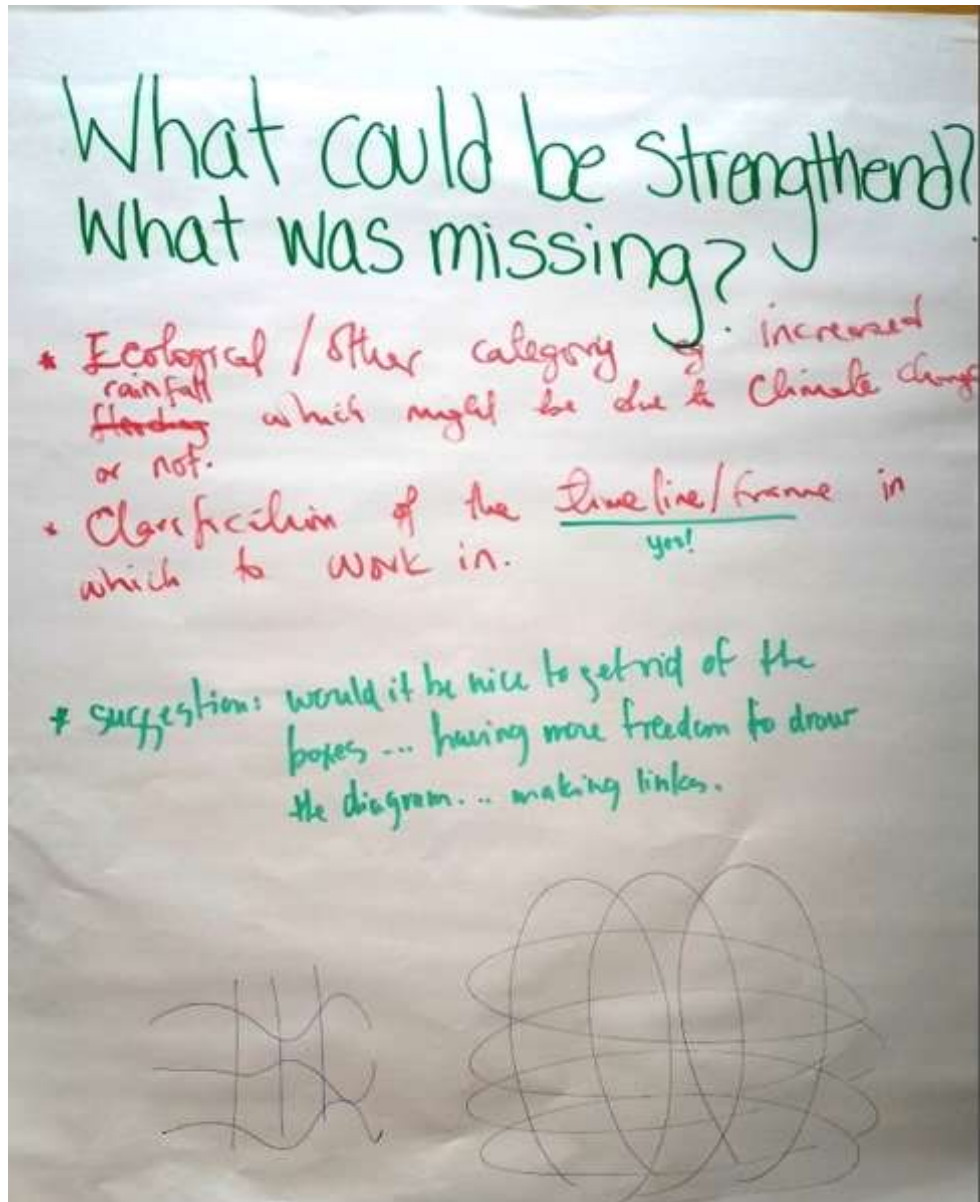


Figure 11.3.5a below is a sample of comments from participants at NTNU regarding the aspects of the conceptual framework and analytical tool that could be strengthened. Source: the author

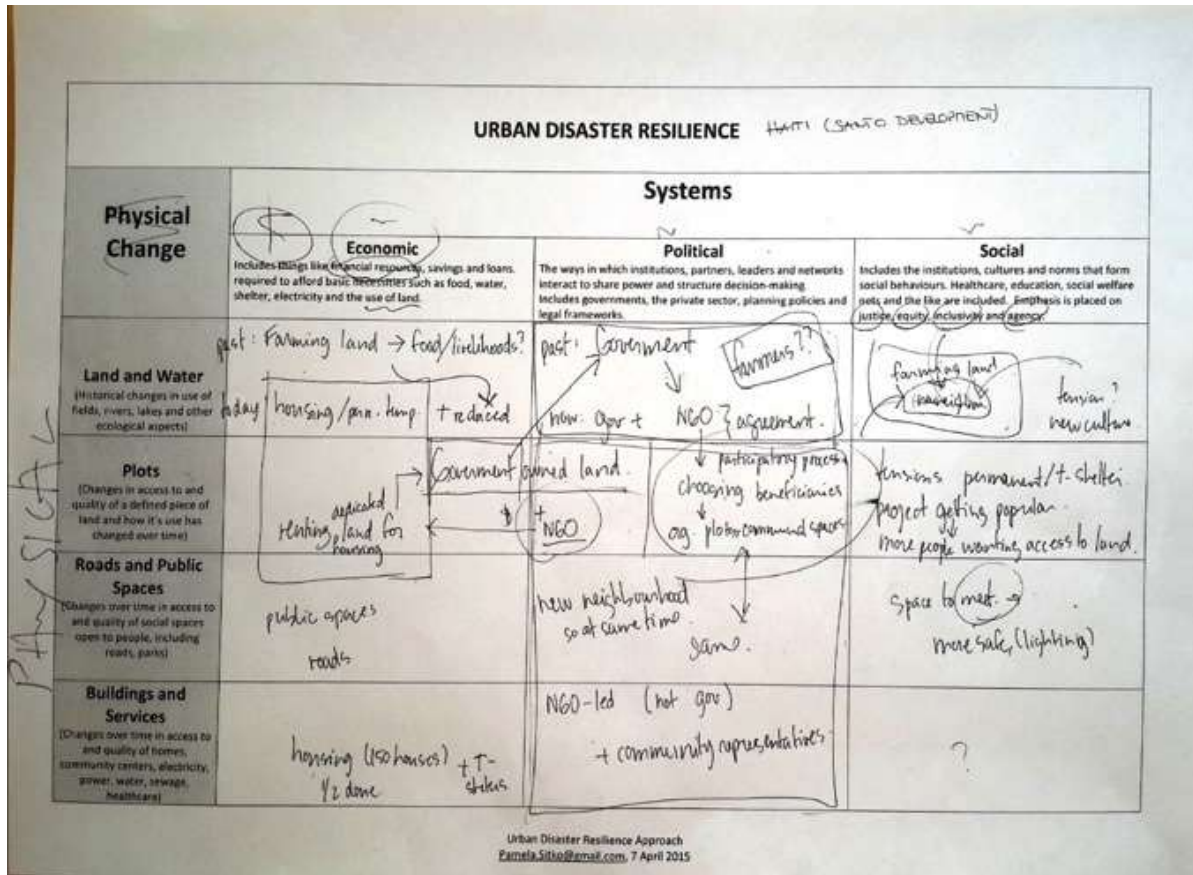


Figure 11.3.5b: A sample of the analytical tool applied to a case study of the 2010 Haiti earthquake by students from NTNU. Arrows are drawn in the boxes to show linkages between the morphological layers and CAS. Source: the author

Conclusion

This chapter set out to explain key generalisable findings from the research. It began by explaining key connections between case study findings and the conceptual framework, noting three connections in particular. Firstly, the role of social dynamics was highlighted, concluding that living in an informal settlement and working in an informal economy requires an aspect of positive social dynamics at every morphological layer. Social dynamics affect activities within all other CAS. Secondly, the importance of a holistic approach at the plots layer was highlighted concluding that effective change at a neighbourhood or individual level requires strategies such as savings groups, security of tenure, good governance structures and high levels of social capital to achieve a transformative and lasting impact. Thirdly, knowing that different morphological layers change at different rates can inform urban professionals engaged in disaster reconstruction to develop appropriate timelines for recovery.

The chapter then explained the connections between the conceptual framework and broader theory, illustrating key generalisable points of the framework, such as it is a people-centred approach; it attempts to bridge the gap between disaster and development paradigms; it considers time and scale; it identifies dimensions of resilience and risk; and lastly, it views disasters as a test of resilience, all of which align with broader theories in development and disaster studies.

The last section of the chapter provided an evaluation of the conceptual framework and analytical tool used throughout the research. It began with an explanation of the analytical tool, noting that the tool is intended for use by practitioners wanting to identify entry points for interventions into a neighbourhood, whom first require an in-depth context analysis that considers the history of an area and the systems that shape it. The process

for validating the conceptual framework and analytical tool was then explained, highlighting that 69 urban professionals participated in the review process and 15 case studies were applied to both the framework and tool.

Following the process of validation, the conceptual framework and analytical tool were both refined, primarily by clarifying definitions used to describe the morphological layers and CAS. The chapter then reviewed the key strengths of the framework and tool as listed by the urban professionals who reviewed them. The primary strengths articulated included the holistic and comprehensive nature of analysis; ease of adaptability to other contexts; and usefulness as a context analysis framework and tool. Some of the limitations listed were that the boxes limited visualisation of the overlaps between systems and morphological layers, which was addressed by encouraging users to add arrows and list pertinent information in every category, even if it results in doubling up on details.

In summary this chapter focused upon drawing connections between cases, the conceptual framework and theory in order to demonstrate the generalisability of both the framework and tool at a theoretical and practical level. The next chapter will provide a conclusion to the overall research, reflecting on the problem statement and the ways in which the research achieved its aim and objectives.

Chapter twelve

Conclusion

Introduction

This chapter reviews the process of meeting the research aim and objectives, in order to identify this thesis's contribution to new knowledge and further opportunities for research. This chapter is organised into three sections. The first section identifies the ways in which the research meets its aim and objectives by reviewing the methodologies employed to achieve them and evaluating the strengths and weaknesses of the research method. The second section explains the research's new contribution to knowledge from a conceptual and practical basis. The third section provides recommendations for future research.

12.1 Meeting research aim and objectives

The research began by identifying a research question. The assumption was that few theories, frameworks, tools and models adequately explore disaster resilience in cities (IFRC 2010). The new urban reality of density and dynamism is a mismatch for the rural assumptions and traditions that

underpin much thinking in humanitarian aid (Ramalingam 2012). Therefore, the question that formed the basis of this research is: What is an appropriate approach for understanding urban disaster resilience in low-income settlements?

Based upon the research question, an overall aim to develop and validate a conceptual framework for understanding urban disaster resilience in low-income neighbourhoods was developed. To achieve the aim, the research set five objectives, namely:

1. **Objective one:** to formulate a conceptual framework for exploring disaster resilience in low-income neighbourhoods.
2. **Objective two:** to develop a methodology for analysing disaster resilience within low-income neighbourhoods.
3. **Objective three:** to apply the methodology in three low-income neighbourhoods to identify key findings and dimensions of resilience.
4. **Objective four:** to validate findings and the conceptual framework with key actors.
5. **Objective five:** to identify the generalisable results of the case studies and conceptual framework for building urban disaster resilience in low-income neighbourhoods.

Respective thesis chapters correspond with meeting one of the five objectives. Objective one, to formulate a framework for exploring disaster resilience, was achieved through the research method of a literature review of key theories on urban, disasters and resilience (Chapter One). Having carried out a literature review, urban form was identified as a crucial lens for understanding vulnerability and resilience. Likewise, complex adaptive systems (CAS) were identified as a key approach for understanding how component parts of urban environments interact and

overlap to create the emergent behaviour of a neighbourhood as a whole. Therefore a conceptual framework for interrogating urban disaster resilience was developed based upon urban morphology and CAS approaches (Chapter Two). A strength of this research methodology was that it took a holistic approach to the literature review by focusing on theory and practice. Moreover, it reviewed literature from a number of disciplines including development and disaster theory, geography, urban design, urban planning, ecology and psychology. A challenge was to include all of the literature on resilience because it spans such a broad scope of disciplines. Another challenge was the fact that the review was conducted in English, thus omitting information on urban disaster resilience in other languages. Nevertheless, an in-depth literature review of theory and practice resulted in a sound conceptual framework for interrogating urban disaster resilience, achieving the first objective.

The second objective was to develop a methodology for analysing disaster resilience within low-income neighbourhoods. This was achieved through a case study approach that utilised data collection methods such as semi-structured interviews with key informants, morphological tools, PRA tools, FGDs, transect walks and review of secondary data (explained in Chapter Three). The research methods were chosen for several reasons. Firstly, the use of spatial tools, such as maps, was important for capturing morphological data. Secondly, methods such as PRA tools, FGDs and semi-structured interviews with key informants recognised people who live in the areas as the most knowledgeable of their circumstance, and allowed for rich expression of diverse attitudes, perceptions and opinions. Lastly, transect walks and a review of secondary data allowed the author to triangulate information gathered through the other methods. The diverse range of qualitative methods was designed to ensure that data collection met the requirements set out in the framework's morphological layers and CAS.

The third objective was to apply the methodology in three low-income neighbourhoods to identify key findings and dimensions of resilience. The methodology was applied to a study of the chronic and acute stresses at a city-scale in Bangkok and the overall Bang Bua Canal before the 2011 flood in Chapter Five, and during and after the flood in Chapter Six. In the interest of investigating a finer resolution of scale, the methodology was then applied to three case studies at a neighbourhood scale with analysis of Bang Bua Neighbourhood in Chapter Seven; Saphan Mai Neighbourhood in Chapter Eight; and Roi Krong Neighbourhood in Chapter Nine, examining events that took place before, during and after the flood. Patterns were examined in the case studies and key findings were developed by using three data analysis methods: morphological analysis for spatial data; context analysis and coding for other data collected through PRA; and semi-structured key informant interviews and FGDs along with other methods listed in the second objective. The coding assisted with identifying themes within a large amount of data.

Meanwhile, the morphological data assisted with categorisation of data at relevant urban layers. Finally, the context analysis data assisted with a historical understanding of the factors that shaped the urban context of today. Coding was particularly helpful because it allowed the author to allocate evidence to multiple themes to develop a more realistic understanding of the overlapping and interconnected aspects of disaster resilience in urban centres. The key findings were then plotted on the conceptual framework to identify dimensions of urban disaster resilience.

The fourth objective was to validate findings and the conceptual framework for building urban resilience with key actors. This was achieved through validating initial key findings in a focus group discussion format within each of the three neighbourhoods as explained in Chapter Ten.

The findings were then reinterpreted by triangulating information provided by the neighbourhoods, key informant interviews and secondary data sources such as documents and maps. Dimensions of disaster resilience were then identified and plotted on the conceptual framework in order to make connections across the case studies.

The fifth objective was to identify the generalisable results of the case studies and conceptual framework, therefore identifying findings relevant to contexts beyond this case study. To achieve this, Chapter Eleven made connections between the case study findings and the conceptual framework that concluded that three general observations could be made, including that social dynamics is the most influential CAS for poorer urban people; that the plots layer was the most influential morphological layer; and that the rate of change within the morphological layers and systems will influence disaster recovery timelines. Five generalisations were then made about the conceptual framework, based on support from theory. Firstly, the framework was found to be a people-centred approach. Secondly, it was felt to have bridged the gap between disasters and development paradigms. Thirdly, it provided an opportunity to conduct scalar and temporal analysis. Fourthly, it used the intersections between morphology and CAS to identify dimensions of resilience and risk. Fifthly, it approached the disaster event as a test of resilience.

In Chapter Eleven the conceptual framework and accompanying analytical tool were validated through three workshops with a total of 69 participants. Both were refined based on feedback from participants. Thus, the objective of to identify of identifying generalisable results of the analytical tool and conceptual framework were achieved in Chapter Eleven.

Thus, by seeking to meet each of the objectives, the overall aim of developing and validating a conceptual framework for understanding urban disaster resilience in low-income areas was achieved.

12.2 Reflections on the research methodology

Overall the research method used to develop a conceptual framework for building urban disaster resilience was relevant and sound. It employed a range of data collections tools and methods; allowed for triangulation of data; and enabled the author to validate key findings. Inevitably however, as is part of the research process where it is assumed approaches can always be improved upon, several limitations and strengths with the methodological framework can be identified.

12.2.1 Limitations

As within any piece of researcher, care must be taken to limit researcher bias as much as possible. To ensure credible research the investigator must demonstrate a true picture of the case study under investigation. Within the data collection phase, care was taken to remove bias by asking open-ended questions that did not lead the respondent and approached the topic neutrally. When listening to answers, care was taken to ensure that the investigator did not influence answers with facial expressions or body language. When answers were given that appeared to be answers that pleased the researcher but did not seem to ring true, the researcher politely challenged the interviewee in a friendly manner. Biased samples, where people are selected for interview who do not represent the majority of the population, were avoided by using random sampling as well as seeking out groups of people who were not power holders in the neighbourhoods and did not often voice their opinions. Finally, critical self-reflection journals were used on a daily basis to sort through the

information collected and demonstrate transparency in the data collection process and overall research methodology.

Two other key limitations within the research stand out.

Availability of accurate maps

Physical information about the neighbourhoods was important to this research, and maps can provide crucial data. However, maps with updated information were not widely available. BMA's building use maps were highly detailed but despite obtaining maps with information from 2014, the map of Bang Bua Neighbourhood still shows houses encroaching over the canal, even though all of the houses had moved on land by 2007. The Roi Krong upgrading committee said it did not possess any of the maps that had been drawn for it by partner organisations. Saphan Mai had two versions of their neighbourhood plans but neither version reflects the state of the neighbourhood today. Even Google maps were out of date, showing Bang Bua Neighbourhood spread out over top of the canal.

Use of PRA tools

The PRA tools used in the research required tailoring due to the fact that activities such as drawing maps had been done during the upgrading as part of the negotiating process. Canal dwellers were not interested in carrying out activities they had already done with other partners or facilitators. They were however enthusiastic and committed to PRA activities related to the flood presumably because it provided the opportunity for reflection and learning regarding what is now a historical event.

12.2.2 Strengths

The following strength within the research methodology stood out.

Analytical tool enhanced communication

The analytical tool became an immensely useful for communicating the conceptual framework to a range of urban practitioners. The tool translated concepts into everyday language in order to validate the generalisability of the conceptual framework.

12.3 Contribution to knowledge

The new contribution to knowledge embodied in this thesis is, it is believed, is that the conceptual framework and analytical tool are urban derived and use urban methodologies and approaches to interrogate the impact of urban disasters. The conceptual framework is theoretically informed on the one hand and the analytical tool is practically based on the other. The theoretical foundation of the framework is intended to help researchers deconstruct a context, to identify key findings and to generalise them. The case study approach can also offer practice a new contribution, making theory operational in its use.

12.3.1 Theoretical contribution

The research makes a new contribution to knowledge through achieving its aim of developing a conceptual framework that understands resilience from a space-based systems approach. By analysing urban vulnerability and risk in the built form and recognising the complexity of overlapping, adaptive systems, the research was able to gain insights into the dimensions that build resilience and those that create risk. As systems and the urban environment co-evolve, adaptive behaviour on many scales takes place. Whether a neighbourhood, city or nation is on the edge of chaos depends upon many complex factors including the speed at which feedback loops occur and the ways in which they influence each other; the capacities that exist within a larger system and its component parts; the changing external and internal environmental conditions; and the threshold a particular system has before it collapses and transforms into a

new basin of attraction, and b whether this is positive or negative. When combined with morphology, a complex adaptive systems approach recognises the context dependent nature of understanding an urban environment. The conceptual framework seeks to contribute to new knowledge by using urban theories to define resilience before, during and after a disaster to identify patterns and the dimensions that build resilience.

The patterns and dimensions have established that resilience is built before and after a disaster, and that the disaster itself is a test of how adaptive systems and the built environment are in terms of learning from historical shocks and stresses and having the capacity to maintain a basic level of functioning. Therefore, based on the conceptual framework, urban disaster resilience can be defined as the ways in which the built environment, complex adaptive systems and people interact to cope, adapt and transform in order to reduce disaster risk.

12.3.2 Practice-based contribution

The practice-based contribution is two fold. The first part is the analytical tool and the way it translates theory into practical means by conducting a context analysis, a capacity and vulnerability assessment or as an evaluation tool if paired with project indicators. It is anticipated that the tool can be used by a diverse group of urban practitioners, including low-income neighbourhoods, aid agencies, urban planners, designers, architects or any other actor interested in assessing a component part of an urban area (or as a whole) and the scalar influences from a local to a national, regional or global level, depending on the type of information required.

The second part is around the definition of resilience and the ways in which the concept can be operationalised by identifying dimensions of

resilience. After identifying dimensions of resilience, neighbourhood residents and their partners can then agree on activities that engage the dimensions of resilience. The co-evolution of urbanisation and risk has meant more density and diversity packed into smaller spaces. This means it is even more important to draw in key urban actors involved in shaping the built and natural environment into mainstream development processes. Moreover it is important to ensure the stakeholders engage in processes that are participatory, inclusive, foster social capital and good governance. Figure 12.3.2a below shows a graphical depiction of the practical and theoretical contributions to knowledge indicated with black arrows at the completion point of the research design.

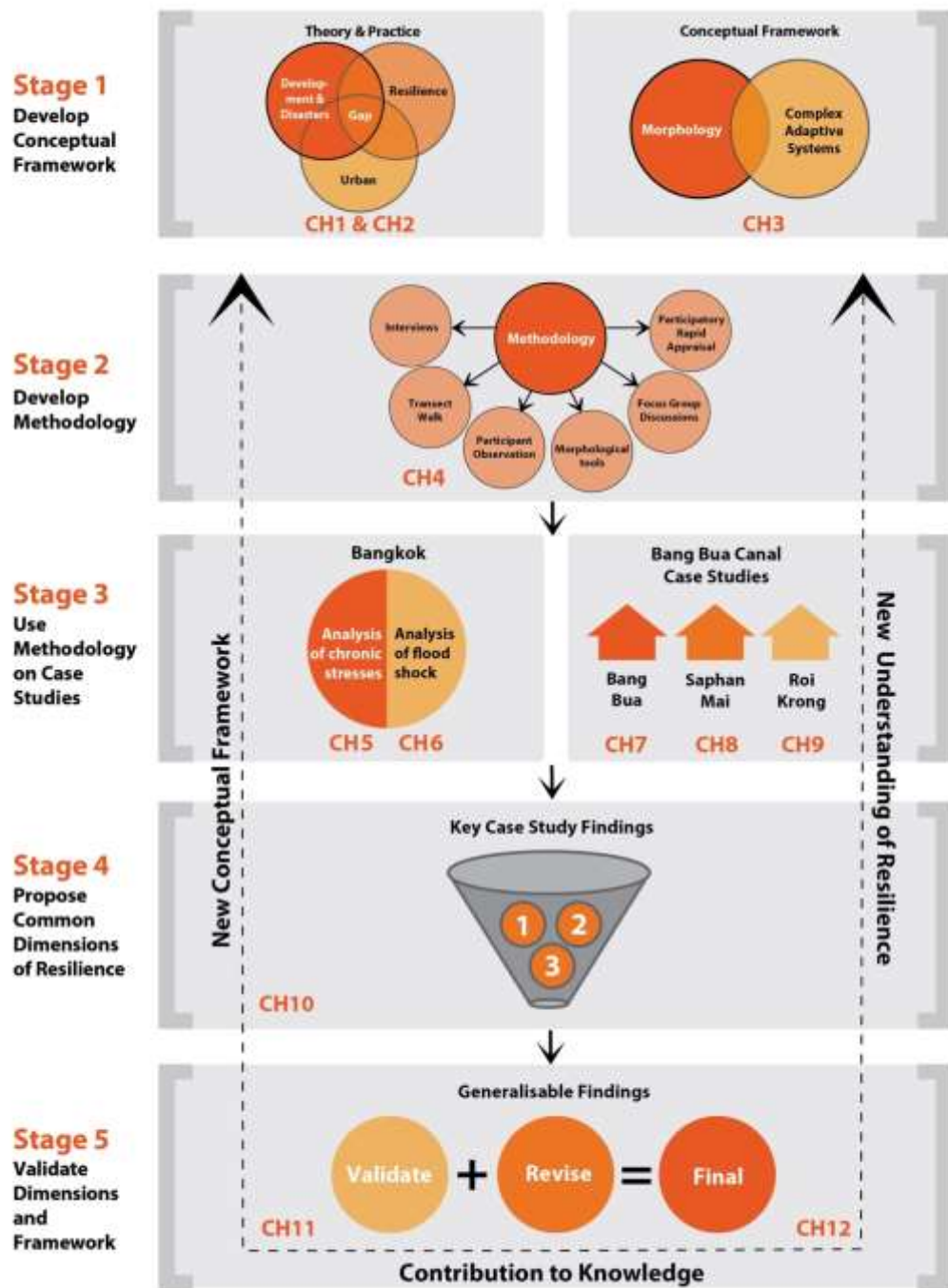


Figure 12.3.2a: Practical and theoretical contributions to knowledge are indicated with black arrows in the research design above. Source: the author

12.4 Recommendations for future research

The research process has identified three areas for potential future research, namely the role of technology, the quandary of how to assist renters, and the potential for using the conceptual framework within urban displacement contexts.

12.4.1 The connection between technology and resilience

Pursuing the way in which technology for social communication impacts resilience is an important area for research. In the case of the Bang Bua Canal during the 2011 floods, poorer people were using traditional modes of communication such as public loud speakers more than they used new forms of technology such as apps and websites to seek and share information.

However, in the few years that have passed since 2011, including during the completion of this thesis, technology has rapidly developed, becoming cheaper and more accessible to poorer people. Cellphones for example, and, increasingly, smartphones are ubiquitous. While data collection was taking place by the author, residents from the neighbourhoods were also collecting data on the research project by documenting the dates and locations of the author's work through group chat apps such as Line on tablet devices that were not affordable a few years earlier. This suggests a study of how urban settlements utilise technology during a disaster could provide some insight into further dimensions of resilience.

12.4.2 The quandary of how to help renters

The situation of renters could provide an interesting opportunity for further study. In general providing rental accommodation after a disaster is difficult due to the damage and destruction of homes. Further research into how to create more rental accommodation after a disaster would benefit both humanitarians and professionals who create the city such as

urban designers, planners, government officials and developers. Furthermore, research into the impact on rental markets after settlement and squatter upgrading could better inform upgrading processes, and especially the ways in which rental properties are dealt with. In Baan Mankong renters were sometimes given the opportunity to own their own homes. However, for many, home ownership is a burden and affordable rentals are key to survival in the city. Clearing settlements of rental properties is reminiscent of rural development approaches. Upgrading must find a way to accommodate dynamic, fluid housing arrangements that suit a wide range of needs.

12.4.3 A systems and morphological approach to urban displacement

Urban displacement is rapidly becoming a new challenge for humanitarians and urban professionals to respond to. Further research could be carried out using an adapted version of the conceptual framework to better understand the humanitarian environment around urban displacement and the corresponding urban design and planning issues. For example, in December 2015, flooding in Chennai, India has displaced more than a million people (Lyengar, 2015). Host governments are buckling under the pressure to support waves of newly displaced groups. The conceptual framework could be used to investigate the vulnerabilities and capacities that result from hosting displaced persons by interrogating the relationship between the built form and CAS. The framework builds upon findings from the literature such as the need to invest in access to quality services in host communities, the importance of supporting local services rather than creating parallel ones, the benefits of area-based programming and addressing the negative social perceptions of the displaced population (NRC and IRC, 2014; IRC, 2014). Thus, the conceptual framework has the potential to be used to identify dimensions of resilience for displaced persons in urban settings.

Conclusion

This chapter has sought to summarise the breadth and scope of the thesis. It began by explaining how the aim and objectives were met by aligning specific chapters with specific objectives. It then described the new contribution to knowledge through avenues of theory by viewing resilience from a space-based systems approach. It also explained the analytical tool and how the identified dimensions of resilience can be considered a new contribution to knowledge from practice because both are tangible ways to operationalise resilience.

Evaluation of the research methodology is then presented with a reflection on the unavailability of accurate maps for conducting research on formal and informal settlements. A reflection on the PRA tools is also given, suggesting the importance of knowing previous research tools used in an area before carrying out new research.

The chapter closes with three ideas for further research. The first is regarding the use of technology and how changes in information collection and sharing in the past few years can impact resilience. The second focuses on the question of how to support renters. The third focuses on urban displacement issues and the ways in which the conceptual framework could provide a rigorous context analysis to identify key issues between CAS and the built form, and from there, develop appropriate interventions. Likewise, similar research could be done on the usefulness of the framework for informing research agendas and prioritising urban activities for agencies working with multiple stakeholders at municipal, national and global levels.

Concluding statement

This research aimed to develop and validate a conceptual framework for understanding urban disaster resilience in low-income neighbourhoods. The study found that resilience has the potential to unite a broad spectrum of urban actors because of its deep-rooted history and widespread use in other disciplines, crucial in urban work. It also concluded that at its core, resilience bridges development and disaster paradigms and can be seen as a political argument for increasing value for money in both development and disaster activities. Finally, it reaffirms that resilience is about building up and improving what already exists in order to thrive, which is a more positive concept than 'reducing' as is emphasised in disaster risk reduction. Ultimately, this research emphasised that resilience is most valuable when users of the word define resilience for whom, and to what.

Bibliography

- AADMER Partnership Group (2015). *About us*. Online: AADMER Partnership Group. Available at: <http://www.aadmerpartnership.org/who-we-are/about-us/> (Accessed: 21 August 2015 2015).
- Abbott, J. (2002). An analysis of informal settlement upgrading and critique of existing methodological approaches. *Habitat International* 26 (3), pp.303-315.
- Adger, N. (2000). Social and ecological resilience; are they related? *Progress in Human Geography* 24 (3), pp.347-364.
- Adger, N. (2001). *Social capital and climate change*. Online: Tyndall Centre for Climate Change Research.
- ADPC (2006). *Critical guidelines: community-based disaster risk management*. Bangkok: ADPC.
- ADPC (2013a). *Assessment of disaster management planning, policies and responses in Thailand*. Bangkok: Asian Disaster Preparedness Center (ADPC), HelpAge International, AADMER Partnership Group (APG).
- ADPC (2013b). *Summary report: assessment of disaster management planning, policies and responses in Thailand*. Bangkok: Asian Disaster Preparedness Center (ADPC).
- Ahmed, A. (2006). *Concepts and practices of "resilience": a compilation from various secondary sources. a working paper prepared for Coastal Community Resilience (CCR) program*. Online: U.S. Indian Ocean Tsunami Warning System (IOTWS) Program.
- Aiken, M. *et al.* (1987). Urban systems theory and urban policy: a four-nation comparison. *British Journal of Political Science* 17 (3), pp.341-358.

- Aldrich, D. (2012). *Building resilience: social capital in post-disaster recovery*. Chicago: University of Chicago Press.
- Alesch, D. (2005). Complex urban systems and extreme events: towards a theory of disaster recovery. In: *First International Conference on Urban Disaster Reduction*. Kobe, Japan, 17 January 2005. Kobe, Japan: First International Conference on Urban Disaster Reduction.
- Alexander, D. (2013). Resilience and disaster risk reduction: an etymological journey. *Natural Hazards and Earth System Sciences* 13 (11), pp.2707-2716.
- Alfani, F. et al. (2015). *Can we measure resilience? A proposed method and evidence from countries in the Sahel*. Online: World Bank Poverty Global Practice Group.
- Aljazeera (2015). Thai ex-PM indicated over rice subsidy scheme. *Aljazeera*, 19 February 2015.
- Allen, A. et al. (2012). *Future proofing cities: risks and opportunities for inclusive growth in developing countries*. London: Atkins.
- Allen, A., Lampis, A. and Swilling, M. (2015). *Untamed Urbanisms*. Abingdon: Routledge.
- Allen, J. (2003). Power as an immanent affair: Foucault and Deleuze's topological detail. *Lost Geographies of Power*. Oxford: Blackwell Publishing, pp.65-92.
- Anderies, M., Walker, B. and Kinzig, A. (2006). Fifteen weddings and a funeral: case studies and resilience based management. *Ecology and Society* 11 (1), p.21.
- Anderson, M., Brown, D. and Jean, I. (2012). *Time to listen: hearing people on the receiving aid of international aid*. Cambridge: CDA Collaborative Learning Projects.
- Anderson, M. and Woodrow, P. (1998). *Rising from the ashes: development strategies in times of disaster*. London: IT Publications.
- Aon Benfield (2012). *2011 Thailand floods event recap report*. Chicago: Aon Benfield.
- Arbon, P. et al. (2013). *How do we measure and build resilience against disaster in communities and households? Input paper prepared for the Global Assessment Report on Disaster Risk Reduction 2015*. Online: UNISDR and GAR.
- Archer, D. (2009). *Social capital and participatory slum upgrading in Bangkok, Thailand*. Doctor of Philosophy. University of Cambridge.
- Arendt, L. and Alesch, D. (2015). *Long-term community recovery from natural disasters*. London: Taylor and Francis Group.
- Arthur, W. B., Durlauf, S. N. and Lane, D. (1997). Introduction. In: Arthur, W. B., Durlauf, S. N. and Lane, D. (eds.) *The economy as an evolving complex system II*. Reading: Addison-Wesley.
- ARUP (2011). *Characteristics of a safe and resilient community: community based disaster risk reduction study*. Geneva: IFRC.
- ASEAN Inter-Parliamentary Assembly (2012). *Thailand: country report on disaster management ASEAN Inter-Parliamentary Assembly, the*

- 4th AIPA caucus, 30 April-3 May 2012. Bangkok, Thailand: ASEAN Inter-Parliamentary Assembly.
- Ashdown, P. (2011). *The humanitarian emergency response review*. London: UK Department for International Development
- Asian Development Bank (2011). *Civil society briefs: Thailand*. Bangkok, Thailand: Asian Development Bank.
- Bahadur, A., Ibrahim, M. and Tanner, T. (2010). *The resilience renaissance? Unpacking of resilience for tackling climate change and disasters. Strengthening climate resilience discussion paper 1*. Brighton: Institute of Development Studies.
- Bahadur, A. and Tanner, T. (2014). Transformational resilience thinking: putting people, power and politics at the heart of urban climate resilience. *Environment and Urbanization* 26 (1), pp.201-214.
- Bang Bua Neighbourhood (nd-a). *Bang Bua Neighbourhood Before Upgrading* Bangkok: CODI.
- Bang Bua neighbourhood (nd-b). *Bang Bua neighbourhood water supply*. Bangkok: CODI.
- Bang Bua Neighbourhood (nd-c). *Bang Bua neighbourhood's drainage system*. Bangkok: CODI.
- Bang Bua Neighbourhood (nd-d). *Bang Bua road systems*. Bangkok: Bang Bua.
- Bang Bua Neighbourhood (nd-e). *Bang Bua upgrading plan*. Bangkok: CODI.
- Bar-Yam, Y. (1997a). *Complexity rising: from human beings to human civilisation, a complexity profile*. Cambridge, MA: New England Complex Systems Institute
- Bar-Yam, Y. (1997b). *The dynamics of complex systems*. Reading, MA: Addison-Wesley
- Barber, R. (2012). *Responding to emergencies in Southeast Asia: can we do better?* Melbourne: Save the Children Australia; Save the Children Asia Regional Office.
- Batabyal, A. (1998). The concept of resilience: retrospect and prospect. *Environment and Development Economics* 3 (2), pp.235-239.
- BB2 (2014). *Bang Bua resident*. In: Sitko, P., ed. Oxford: Oxford Brookes University.
- BB4 (2014). *Bang Bua interview*. In: Sitko, P., ed. Oxford: Oxford Brookes University.
- BB18 (2014). *Bang Bua resident*. In: Sitko, P., ed. Oxford: Oxford Brookes University.
- BB20 (2014). *Bang Bua resident*. In: Sitko, P., ed. Oxford: Oxford Brookes University.
- BBC (2015a). Thai ex-PM Yingluck indicted for negligence over rice subsidy scheme. *BBC* 19 February 2015.
- BBC (2015b). Thailand impeaches Yingluck Shinawatra over rice scheme. *BBC*, 23 January 2015.
- BBC News (2015). Thai military government replaces martial law. *BBC News*, 1 April 2015.

- BBFGD1 (2014). *Bang Bua focus group discussion 1*. In: Sitko, P., ed. Oxford: Oxford Brookes University.
- Beilin, R. and Wilkinson, C. (2015). Introduction: governing for urban resilience. *Urban Studies* 52 (7), pp.1-13.
- Bene, C. (2013). *Towards a quantifiable measure of resilience*. London: Institute of development studies (IDS).
- Benson, C., Twigg, J. and Myers, M. (2002). NGO initiatives in risk reduction: an overview. *Disasters* 25 (3), pp.199-215.
- Berkout, F. (2008). *Order in socio-technological systems: the dark side of resilience*. In: Leach, M., ed. *Re-framing resilience: a symposium report*. Brighton: Institute of Development Studies (IDS).
- Blackburn, S. and Johnson, C. (2012). *Making cities resilient report 2012*. In: Bittner, P., ed. online: UNISRD.
- Boin, A., Comfort, L. and Demchak, C. (2010). The rise of resilience. In: Comfort, L., Boin, A. and Demchak, C. (eds.) *Designing resilience: preparing for extreme events*. Pittsburg: University Pittsburg Press, pp.1-12.
- Bolio Arceo, E. (2012). *Urban transformations and place-identity: the case of Merida, Mexico*. Doctor of Philosophy Oxford Brookes University.
- Boonyabantha, S. (2004). A decade of change: from the urban community development office to the community organisation development institute in Thailand. In: Mitlin, D. and Satterthwaite, D. (eds.) *Empowering Squatter Citizen*. London: Earthscan.
- Boonyabantha, S. (2005). Baan Mankong: going to scale with "slum" and squatter upgrading in Thailand. *Environment and Urbanization* 17 (1), pp.21-46.
- Boonyabantha, S. (2009). Land for housing the poor - by the poor: experiences from the Baan Mankong nationwide slum upgrading programme in Thailand *Environment and Urbanization* 21 (2), pp.309-329.
- Boonyabantha, S. and Archer, D. (2011). *Thailand's floods: complex political and geographical factors behind the crisis*. Online: International Institute for Environmental Development. Available at: <http://www.iied.org/thailands-floods-complex-political-geographical-factors-behind-crisis> (Accessed: 8 January 2015 2015).
- Boonyabantha, S., Carcellar, N. and Kerr, T. (2012). How poor communities are paving their own pathways to freedom. *Environment and Urbanization* 24 (2), pp.441-462.
- Botchway, F. (2000). Good governance: the old, the new, the principle, and the elements. *Florida Journal of International Law* 13, p.159.
- Brown, D. et al. (2015). *Urban crises and humanitarian responses: a literature review*. London: The Bartlett Development Planning Unit.
- Brown, K. and Westaway, E. (2011). Agency, capacity and resilience to environmental change: Lessons from human development, well-

- being and disasters. *Annual Review of Environment and Resources* 36, pp.321-342.
- Bruijne, M., Boin, A. and van Eeten, M. (2010). Resilience: exploring the concept and its meanings. In: Comfort, L., Boin, A. and Demchak, C. (eds.) *Designing resilience: preparing for extreme events*. Pittsburg: University Pittsburg Press, pp.pp13-32.
- Bryman, A. (2008). *Social research methods*. 3rd ed. Oxford: Oxford University Press.
- Buchanan-Smith, M. and Fabbri, P. (2005). *Linking relief, rehabilitation and development: A review of the debate*. London.
- Buchanan-Smith, M. and Maxwell, S. (1994). Linking relief and development: An introduction and overview. *IDS Bulletin* 25 (4), pp.2-16.
- Bull-Kamanga, L. et al. (2003). From everyday hazards to disasters: the accumulation of risk in urban areas. *Environment and Urbanization* 15 (1), pp.193-204.
- Butina Watson, G. and Bentley, I. (2007). *Identity by design*. Oxford: Elsevier.
- Butina Watson, G. et al. (2004). *Learning from Poundbury*. Oxford: Oxford Brookes University.
- Cannon, T. (2008). *Reducing people's vulnerability to natural hazards: communities and resilience*. United Nations University: United Nations University.
- Cannon, T. and Muller-Mahn, D. (2010). Vulnerability, resilience and development discourses in the context of climate change. *Natural Hazards* 55 (3), pp.621-635.
- Cannon, T. and Schipper, L. (2014). *World Disasters Report 2014: focus on culture and risk*. Geneva: IFRC.
- Carmona, M., Heath, T. and Tiesdell, S. (2003). *Public places urban spaces*. Oxford: Elsevier.
- Carpenter, S. et al. (2001). Metaphor to measurement: resilience of what to what? *Ecosystems* 4 (8), pp.765-781.
- Center for Excellence in Disaster Management and Humanitarian Assistance (2015). *Thailand: disaster reference handbook*. Hawaii: Center for Excellence in Disaster Management and Humanitarian Assistance.
- Chambers, R. (1994). The origins and practice of participatory rural appraisal. *World Development* 22 (7), pp.953-969.
- Chambers, R. (1997). *Who's reality counts? Putting the first last*. Bourton on Dunsmore: Practical Action Publishing.
- Chambers, R. (2002). *Participatory workshops - a sourcebook of 21 sets of ideas and activities*. London: Earthscan.
- Chambers, R. and Conway, G. (1991). *Sustainable rural livelihoods: practical concepts for the 21st century*. Brighton: Institute of Development Studies.
- Chambwera, M., MacGregor, J. and Baker, A. (2011). *The informal economy*. London.

- Chandler, D. (2015). Rethinking the conflict-poverty nexus: from securitising intervention to resilience. *Stability: International Journal of Security and Development* 4 (1), pp.1-14.
- Chant, S. and McIlwaine, C. (2009). *Geographies of development in the 21st century: an introduction to the global South*. Cheltenham: Edward Elgar Publishing Limited.
- Choi, H. (2011). *Place identity in 21st century contemporary new town development in South Korea: Using the case of the proposed multifunctional administrative city in South Korea*. Doctor of Philosophy Oxford Brookes University.
- Christoplos, I., Liljelund, A. and Mitchell, J. (2001). Re-framing risk: the changing context of disaster mitigation and preparedness. *Disasters* 25 (3), pp.185-198.
- Citiscopes (2015). *What is the new urban agenda?* Online: Citiscopes. Available at: <http://citiscopes.org/habitatIII/explainer/2015/06/what-new-urban-agenda> (Accessed: 13 December 2015).
- Clermont, C. et al. (2011). *Urban disasters - lessons from Haiti*. London: Disasters Emergency Committee (DEC).
- Cleveland, J. (2005). *Complex adaptive systems theory*. Online: Innovation Networks for Communities.
- Collins, A. (2009). *Disaster and development*. Abingdon: Routledge.
- Combaz, E. (2015). *Disaster Resilience: A Topic Guide*. Birmingham, UK: GSDRC, University of Birmingham.
- Creswell, J. (2007). *Qualitative inquiry and research design: choosing among five approaches*. London: Sage.
- Cross, T. and Johnston, A. (2011). *Cash transfer programming in urban emergencies: a toolkit for practitioners*. Oxford: Cash Learning Partnership.
- Cutter, S. et al. (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change* 18, pp.598-606.
- da Silva, J. (2014). *City resilience framework*. London: Arup and the Rockefeller Foundation
- da Silva, J., Kernaghan, S. and Luque, A. (2012). A systems approach to meeting the challenges of urban climate change *International Journal of Urban Sustainable Development* 4 (2), pp.1-21.
- da Silva, J. et al. (2010). *The urban resilience framework*. Online: Arup and ISET.
- de Haan, A. (2009). *How the aid industry works*. Sterling: Kumarian Press.
- de Soto, H. (1989). *The other path: the economic answer to terrorism*. New York: Basic Books.
- de Soto, H. (2000). *The mystery of capital*. London: Bantam Press.
- de Vaus, D. (2001). *Research design in social research*. London: Sage.
- Demchak, C. (2010). Lessons from the military: surprise, resilience and the atrium model. In: Comfort, L., Boin, A. and Demchak, C. (eds.)

- Designing resilience: preparing for extreme events*. Pittsburg: University Pittsburg Press, pp.62-83.
- Department of City Planning, B. (2013a). *Elevation map of Bangkok. The Bangkok comprehensive plan*. Bangkok: Bangkok Metropolitan Administration.
- Department of City Planning, B. (2013b). *The open space plan in the addendum to the ministerial regulation on the Bangkok Comprehensive Plan 2013 (B.E. 2556). The Bangkok Comprehensive Plan*. Bangkok: The City Planning Department, Bangkok Metropolitan Administration
- Department of City Planning, B. (2013c). *Waterways of Bangkok. The Bangkok Comprehensive Plan 2013*. Bangkok: Bangkok Metropolitan Administration.
- Department of City Planning, B. (2013d). *เขตกรุงเทพมหานคร (District Map)* Bangkok: Bangkok Metropolitan Administration.
- Department of City Planning, B. (2014a). *Bang Bua building use map*. Bangkok: Bangkok Metropolitan Authority
- Department of City Planning, B. (2014b). *Bang Bua canal satellite map*. Bangkok Department of City Planning, BMA.
- Department of City Planning, B. (2014c). *Bang Khen district map* Bangkok: Department of City Planning, Bangkok Metropolitan Administration.
- Department of City Planning, B. (2014d). *Saphan Mai building use map*. Bangkok: Bangkok Metropolitan Authority.
- Devereux, S. (2002). Can social safety nets reduce chronic poverty? *Development Policy Review* 20 (5), pp.657-675.
- DFID (2004). *Disaster risk reduction: a development concern*. London: DFID.
- DFID (2011a). *Defining disaster resilience: a DFID approach paper*. London.
- DFID (2011b). *Saving lives, preventing suffering and building resilience: The UK government's humanitarian policy*. London: Department for International Development.
- Djalante, R., Holley, C. and Thomalla, F. (2011). Adaptive governance and managing resilience to natural hazards. *International Journal of Disaster Risk Science* 2, pp.1-14.
- Dodman, D. et al. (2013). *Understanding the nature and scale of urban risk in low - and middle - income countries and its implications for humanitarian preparedness, planning and response*. London: International Institute for the Environment and Development (IIED).
- Dovey, K. and King, R. (2011). Forms of informality: morphology and visibility of informal settlements. *Built Environment* 37 (1), pp.11-29. [Online]. Available at: <http://www.ingentaconnect.com/content/alex/benv/2011/00000037/00000001/art00002> (Accessed 22 January 2013).

- Eckstein, H. (2000). Case study and theory in political science. In: Gomm, R., Hammersley, M. and Foster, P. (eds.) *Case Study Method*. London: Sage.
- Economist, T. (2013). The rise of the sharing economy. *The Economist*, 9 May 2013.
- Elhadj, A. and Molleklev, S. (2015). *Building community resilience bridges humanitarian and development goals*. Online: IFRC. Available at: <http://www.ifrc.org/en/news-and-media/opinions-and-positions/opinion-pieces/2015/building-community-resilience-bridges-humanitarian-and-development-goals/> (Accessed: 13 December 2015).
- EMI (2012). *Programmatic directions for the Red Cross and Red Crescent in building urban community resilience in the Asia Pacific Region*. Quezon City: Earthquake and Megacities Initiative.
- Escobar, A. (1995). *Encountering development: the making and unmaking of the third world*. Princeton: Princeton University Press.
- Fiksel, J. (2006). Sustainability and resilience: toward a systems approach. *Sustainability: Science, Practice and Policy* 2 (2), pp.14-21.
- Folke, C. (2006). Resilience: the emergence of a perspective for socio-ecological systems analysis. *Global Environmental Change* 16, pp.253-267.
- Food Security Information Network (2015). *Resilience measurement*. Online: Food Security Information Network (FSIN). Available at: <http://www.fsincop.net/topics/resilience-measurement/en/> (Accessed: 24 August 2015).
- Ford Foundation (2004). *Building assets to reduce poverty and injustice*. New York: Ford Foundation.
- Friend, R. and MacClune, K. (2013). *Putting resilience into practice*. Boulder: Institute for Social and Environmental Transition-International.
- Friend, R. and Moench, M. (2013). What is the purpose of urban climate resilience? Implications for addressing poverty and vulnerability. *Urban Climate* 6, pp.98-113.
- Gall, M., Cutter, S. and Nguyen, K. (2014). *Governance in disaster risk management*. Beijing: IRDR AIRDR.
- Gallopin, G. (2007). Linkages between vulnerability, resilience and adaptive capacity. In: *Formal Approaches to Vulnerability*. Potsdam Institute for Climate Impact Research, Potsdam Institute for Climate Impact Research.
- Gass, P., Hove, H. and Parry, J. (2011). *Review of current and planned adaptation action: East and Southeast Asia*. Online: Adaptation Partnership.
- Gauthier, P. and Gilliland, J. (2006). Mapping urban morphology: a classification scheme for interpreting contributions to the study of urban form. *Urban Morphology* 10.1.
- Gauthiez, B. (2004). The history of urban morphology. *Urban Morphology* 8 (2), pp.71-89. [Online]. Available at:

- http://www.urbanform.org/online_public/2004_2.shtml (Accessed 23 January 2013).
- Gehl, J. (2007). Public spaces for a changing public life. In: Ward-Thompson, C. and Travlou, P. (eds.) *Open Space, People Space*. Abingdon, Oxon: Taylor and Francis, pp.3-9.
- Geilfus, F. (2008). *80 tools for participatory development* San Jose: Inter-American Institute for Cooperation of Agriculture (IICA).
- Gilbert, A. (2002). Housing Policy and Legal Entitlements: Survival strategies of the urban poor. In: Abel, C. and Lewis, C. (eds.) *Exclusion and engagement: social policy in Latin America*. London: Institute of Latin American Studies, pp.303-330.
- Gilbert, A. a. G., J. (1992). *Cities, poverty and development: urbanisation in the third world*. 2nd ed. Oxford: Oxford University Press.
- Godschalk, D. (2003). Urban hazard mitigation: creating resilient cities. *Natural Hazards Review* 4 (3), pp.136-143. [Online].
- Griffin, L. (2011). Making communities resilient to crisis: exploring the tensions and dilemmas. In: *Politics of the Brain Workshop*. University of Westminster, London, May 2011. London: University of Westminster.
- Grunewald, F. et al. (2011). *Humanitarian aid in urban settings: current practice, future challenges*. La Fontaine des Martins: Groupe URD (Urgence - Rehabilitation - Development).
- Guimarães, J. (2009). *Participatory approaches to rural development and rural poverty alleviation*. Netherlands: Institute of Social Sciences.
- Gunderson, L. (2010). Ecological and human community resilience in response to natural disasters. *Ecology and Society* 15 (2), p.Online.
- Gunderson, L. H. and Holling, C. S. E. (2002). *Panarchy: understanding transformation in human and natural systems*. Washington DC: Island Press.
- Habitat II (1996). *Report of the United Nations conference on human settlements (Habitat II)*. Istanbul: United Nations.
- Habitat III (2015a). *About Habitat III*. Online: Habitat III. Available at: <https://http://www.habitat3.org/the-new-urban-agenda/about> (Accessed: 13 December 2015).
- Habitat III (2015c). *Habitat III issue papers: 1 - Inclusive Cities*. New York: UN-Habitat.
- Habitat III (2015d). *Habitat III issue papers: 5 - Urban rules and legislation*. New York: UN-Habitat.
- Habitat III (2015b). *Habitat III issue papers: 10 - Housing*. New York: UN-Habitat.
- Habitat III (2015e). *Habitat III issue papers: 22 - Informal settlements*. New York: UN-Habitat.
- Habitat III (2015f). *Habitat III issues papers: 15 Urban Resilience*. New York: UN-Habitat
- Habitat III (2015g). *Habitat III issues papers: 18 - Urban Infrastructure and Basic Services, Including Energy*. New York: UN-Habitat.

- Habitat III (2015h). *Habitat issues papers: 8 - Urban and spatial planning and design*. New York: UN-Habitat.
- Hamdi, N. (2004). *Small change: about the art of practice and the limits of planning in cities*. London: Earthscan.
- Hamdi, N. (2010). *The placemaker's guide to building community*. London: Earthscan.
- Hamdi, N. and Geothert, R. (1997). *Action planning for cities*. Chichester: Wiley.
- Hamza, M. (2015). *World disasters report 2015: focus on local actors, the key to humanitarian effectiveness*. Geneva: IFRC.
- Hancock, A. (2009). *The NGOs and humanitarian reform project: strengthening partnership for effective humanitarian response*. Ditchley Park: IRC.
- Handelman, H. (2009). *The challenge of third world development*. 7th ed. New Jersey: Pearson Education Inc.
- Haraguchi, M. and Upmanu, L. (2014). Flood risks and impacts: a case study of Thailand's floods in 2011 and research questions for supply chain decision making. *International Journal of Disaster Risk Reduction*.
- Hardoy, J. and Satterthwaite, D. (1989). *Squatter citizen: life in the urban third world*. London: Earthscan.
- Harmer, A. and Macrae, J. (2004). *Beyond the continuum: the changing role of aid policy in protracted crises*. London: HPG.
- Harvey, P. and Bailey, S. (2015). *Cash transfer programming and the humanitarian system*. London: ODI.
- Hay, J. (2012). *Disaster risk reduction and climate change adaptation in the Pacific: An institutional and policy analysis*. Suva, Fiji: UNISDR and UNDP.
- Heijmans, A. (2013). *Reaching resilience: handbook resilience 2.0 for aid practitioners and policymakers*. Online: European Commission.
- Hettne, B. (2002). Current trends and future options in development studies. In: Desai, V. and Potter, R. (eds.) *The Companion to Development Studies*. London: Arnold, pp.7-12.
- Holling, C. (2010). *Engineering resilience versus ecological resilience*. In: Gunderson, L., Allen, C. and Holling, C., eds. *Foundations of Ecological Resilience*. Washington: Island Press.
- Holling, C. S. (2001). Understanding the complexity of economic, ecological, and social systems. *Ecosystems* 4, pp.390-405.
- Hossain, F., Rees, C. and Knight Millar, T. (2012). Success factors of microcredit: what we can learn for international development? In: Hossain, F., Rees, C. and Knight Millar, T. (eds.) *Microcredit and international development: contexts, achievements and challenges*. Abingdon: Routledge.
- ICLEI (2015). *Glossary of key terms*. Online: ICLEI. Available at: <http://resilient-cities.iclei.org/resilient-cities-hub-site/resilience-resource-point/glossary-of-key-terms/> (Accessed: 11 December 2015).

- IDNDR (1994). *Yokohama strategy and plan of action for a safer world: guidelines for natural disaster prevention, preparedness and mitigation*. Yokohama: IDNDR.
- IFRC (2004). *World disasters report: From risk to resilience - helping communities cope with crisis*. Geneva.
- IFRC (2007a). *Annotations to the draft guidelines for the domestic facilitation and regulation of International disaster relief and initial recovery assistance*. Geneva: IFRC.
- IFRC (2007b). *VCA Toolbox with reference sheets*. Geneva: IFRC.
- IFRC (2015). *Complex/manmade hazards: complex emergencies*. Online: IFRC. Available at: <http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/complex-emergencies/> (Accessed: 16 December 2015).
- ILO (2002). *Decent work and the informal economy International Labour Conference, 90th Session, Report VI*. Geneva: International Labour Organisation.
- ILO (2014). *Transitioning from the informal economy. International Labour Conference 103rd session 2014*. Geneva.
- Inter-Agency and Expert Group on MDG Indicators (2015). *The Millennium Development Goals Report 2015*. Online: United Nations Secretariat.
- Inter-Agency Standing Committee (2006). *Protection of persons affected by natural disasters: operational guidelines on human rights and natural disasters*. Washington DC: Inter-Agency Standing Committee.
- International, A. (2014). *City resilience framework*. London: Arup International.
- IRC (2014). *Responding to urban displacement: what needs to be done (ditchley park conference 2014 discussion summary and outcomes report)*. Online: International Rescue Committee.
- IRIN (2012). Thailand: Authorities boost flood-control measures. *IRIN*, 1 February 2015.
- Jabeen, H., Johnson, C. and Allen, A. (2010). Built-in resilience: learning from grassroots coping strategies to climate variability. *Environment and Urbanization* 22 (2), pp.415-431.
- Jacobs, J. (1961a). *The death and life of great american cities*. New York and Toronto: Random House.
- Jacobs, J. (1961b). *The death and life of great american cities: the failure of town planning*. London: Peregrine Books.
- Jaitman, L. and Brakarz, J. (2013). *Evaluation of slum upgrading programmes: literature review and methodological approaches*. Washington, D.C: Inter-American Development Bank.
- Janssen, M. *et al.* (2006). Scholarly networks on resilience, vulnerability and adaptation within the human dimensions of global environmental change. *Global Environmental Change* 16 (no issue), pp.240-252.

- Jha, A., Bloch, R. and Lamond, J. (2012). *Cities and flooding: a guide to integrated urban flood risk management for the 21st century*. Washington DC: The World Bank.
- Joakim, E., Mortsch, L. and Oulahan, G. (2015). Using vulnerability and resilience concepts to advance climate change adaptation. *Environmental Hazards* 14 (2), pp.137-155.
- Johnson, A. (2009). *Leadership in a slum: a Bangkok case study*. Oxford: Regnum Bookes International.
- Johnson, C. and Blackburn, S. (2014). Advocacy for urban resilience: UNISDR's Making Cities Resilient campaign. *Environment and Urbanization* 26 (1), pp.29-52.
- Juarrero, A. (2000). Dynamics in action: international behaviour as a complex system. *Emergence* 2 (2), pp.24-57.
- Kafle, S. (2010). *Integrated community based risk reduction: an approach to building disaster resilient communities*. Online: Canadian Red Cross.
- Kaplan, H. (1999). Toward an understanding of resilience: a critical review of definitions and models. In: Glantz, M. and Johnson, J. (eds.) *Resilience and development*. New York: Kluwer.
- Karaman, A. (2001). Defining the regional identity: conceptual parameter of urban morphology. *NED Journal of Architecture and Planning* 1 (Townscapes).
- Keeley, B. (2007). *Human capital: how what you know shapes your life*. Paris: OECD Publishing.
- Kelman, I., Gaillard, J. and Mercer, J. (2015). Climate change's role in disaster risk reduction's future: beyond vulnerability and resilience. *International Journal of Disaster Risk Science* 6 (1), pp.21-27.
- Kesby, M. (2005). Retheorizing empowerment-through-participation as a performance in space: beyond tyranny to transformation. *Signs* 30 (4), pp.2037-2065.
- KI2 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- KI3 (2014). In: Sitko, P., ed. *CODI*. Oxford: Oxford Brookes University.
- KI4 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- KI7 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- KI9 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- KI13 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- KI14 (2014). In: Sitko, P., ed. *CODI*. Oxford: Oxford Brookes University.
- KI30 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- KI32 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- KI33 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- KI37 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- Klak, T. (2002). World-systems theory: centres, peripheries and semi-peripheries. In: Desai, V. and Potter, R. (eds.) *The companion to development studies*. London: Arnold, pp.107-111.
- Koontanakulvong, S. (2012). *Thailand floods 2011: causes and future management systems*. Bangkok: Chulalongkorn University.

- Koster, E. (1998). Urban morphology and computers. *Urban Morphology* 2 (1), pp.3-7.
- Kostof, S. (1991). *The city shaped: urban patterns and meanings through history*. London: Thames & Hudson.
- Kropf, K. (2005). The handling characteristics of urban form. *Urban Design* Winter 2005 (93), pp.17-18.
- Kropf, K. (2009). Aspects of urban form. *Urban Morphology* 13 (2), pp.105-120.
- Kyazze, A., Baizan, P. and Carpenter, S. (2012). *Learning from the city: British Red Cross urban learning project scoping study*. London: British Red Cross.
- Lebel, L. et al. (2006). Governance and the capacity to manage resilience in regional social-ecological systems. *Ecology and Society* 11 (1), p.19.
- Levin, S. A. (1998). Ecosystems and the biosphere as complex adaptive systems. *Ecosystems* 1, pp.431-436.
- Levine, S. et al. (2012). *The relevance of 'resilience'?* London: Humanitarian Policy Group.
- Levy, A. (1999). Urban morphology and the problem of the modern urban fabric: some questions for research. *Urban Morphology* 3 (2), pp.79-85.
- Lin, N. (1999). Building a network theory of social capital. *Connections* 22 (1), pp.28-51.
- Lucci, P. (2014). *An urban dimension in a new set of development goals*. London: ODI
- Luthar, S. and Cicchetti, D. (2000). The construct of resilience: implications for interventions and social policies. *Dev. Psychopathol* 12 (4), pp.857-885.
- Lyengar, R. (2015). The death toll from Chennai floods in India nears 270 as city remains at a standstill. *Times*, 4 December 2015.
- Lynch, K. (1981). *A theory of good city form*. Cambridge, MA: MIT Press.
- MacClune, K., Tyler, H. and Allan, C. (2014). *Introduction to a new approach to urban resilience: Final report to American Red Cross on urban resilience*. Boulder, CO: Institute for Social and Environmental Transition-International.
- Madanipour, A. (2010). Public space and everyday life in urban neighbourhoods. In: Madanipour, A. (ed.) *Whose Public Space? International Case Studies in Urban Design and Development*. London: Routledge, pp.107-110.
- Maldonado, N. (2010). The World Bank's evolving concept of good governance and its impact on human rights. In: *Doctoral workshop on development and international organisations*. Stockholm, Sweden, University of Bonn: University of Bonn, Law School.
- Manyena, S. (2006). The concept of resilience revisited. *Disasters* 30 (4), pp.433-450.
- Marshall, C. and Rossman, G. (2011). *Designing qualitative research*. 5th edition ed. Thousand Oaks: Sage Publications.

- Martin-Breen, P. and Anderies, M. (2011). *Resilience: a literature review*. NY: The Rockefeller Foundation.
- Mason, J. (2005). *Qualitative researching*. Second ed. London: Sage.
- Massey, D. (1991). A global sense of place. *Marxism Today* June 1991, pp.24-29.
- Massey, D. (1993). Power-geometry and a progressive sense of place. In: Bird, J. et al. (eds.) *Mapping the futures. Local cultures, global change*. London: Routledge, pp.59-69.
- Mayunga, J. (2007). Understanding and applying the concept of community disaster resilience: a capital-based approach. In: *Megacities: social vulnerability and resilience building*. Munich, Germany, 2007 Summer Academy.
- McCallin, B. and Scherer, I. (2015). *Urban informal settlers displaced by disasters: challenges to housing responses*. Geneva: Internal Displacement Monitoring Centre (IDMC).
- McClean, D. (2010). *World disasters report 2010: focus on urban risk*. Geneva: IFRC.
- McCreight, R. (2010). Resilience as a goal and standard in emergency management. *Journal of Homeland Security and Emergency Management* 7 (1), pp.1-7.
- McEntire, D. et al. (2002). A comparison of disaster paradigms: the search for a holistic policy guide. 62 (3), pp.267-281. American Society for Public Administration [Online]. Available at: <http://www.istor.org/stable/pdfplus/3110212.pdf?acceptTC=true> (Accessed 12 March 2013).
- McGranahan, G. and Satterthwaite, D. (2014). *Urbanisation concepts and trends*. London: IIED.
- Meikle, S., Ramasut, T. and Walker, J. (2001). *Sustainable urban livelihoods: concepts and implications for policy. Paper No 112*. London: UCL.
- Mosel, I. and Levine, S. (2014). *Remaking the case for linking relief, rehabilitation and development*. London: HPG.
- Moser, C. (1983). Evaluating community participation in urban development projects. In: *Proceedings of a Workshop*. University College London: Development Planning Unit: Development Planning Unit.
- Moser, C. (1995). Urban social policy and poverty reduction *Environment and Urbanization* 7 (1), pp.159-172.
- Moser, C. (1998). Reassessing urban poverty reduction strategies: the asset vulnerability framework. *World Development* 26 (1), pp.1-19.
- Moser, C. (2006). *Asset-based approaches to poverty reduction in a globalized context: an introduction to asset accumulation policy and summary of workshop findings*. Washington, DC: The Brookings Institution.
- Moser, C. (2008). Assets and livelihoods: a framework for asset-based social policy. *New frontiers of social policy: assets, livelihoods and social policy*. Washington: World Bank, pp.43-84.

- Moser, C. (2011). A conceptual and operational framework for pro-poor asset adaptation to urban climate change. In: Hoornweg, D. *et al.* (eds.) *Cities and climate change: responding to an urgent agenda*. Washington, DC: The World Bank.
- Moudon, A. (1997). Urban morphology as an emerging interdisciplinary field. *Urban Morphology* 1, pp.3-10. [Online]. Available at: http://www.urbanform.org/online_public/1997_1.shtml (Accessed 22 January 2013).
- National Housing Authority of Thailand (2011). *Low-income communities in Bangkok affected by the 2011 floods*. Bangkok: Department of Housing Development Studies and National Housing Authority of Thailand.
- NRC and IRC (2014). *No escape: civilians in syria struggle to find safety across borders*. Online: Norwegian Refugee Council and International Rescue Committee
- Oddsottir, F., Lucas, B. and Combaz, E. (2013). *Measuring disaster resilience*. Online: GSDRC.
- Olarn, K. (2011). Concerns, floodwaters rise in Bangkok. *CNN*, 7 November 2015.
- Otto, R. and Weingärtner, L. (2013). *Linking relief and development: more than old solutions for old problems?*
- Pacione, M. (2001). *Urban geography: a global perspective*. Third ed. London: Taylor and Francis.
- Pain, A. and Levine, S. (2012). *A conceptual analysis of livelihoods and resilience: addressing the 'insecurity of agency'*. HPG Working Paper. London: ODI.
- Parker, E. and Maynard, V. (2015). *Humanitarian response to urban crises: a review of area-based approaches*. London: International Institute for Environment and Development (IIED).
- Peel, M. (2014). Bangkok's emergency rule illustrates struggle for control. *Financial Times*, 22 January 2014.
- Pelling, M. (2003). *The vulnerability of cities*. London: Earthscan.
- Pelling, M. (2011a). *Adaptation to climate change: from resilience to transformation*. Abingdon: Routledge.
- Pelling, M. (2011b). Urban governance and disaster risk reduction in the Caribbean: the experiences of Oxfam GB. *Environment and Urbanization* 23 (2), pp.1-11.
- Pelling, M. and Manuel-Navarrete, D. (2011). From resilience to transformation: the adaptive cycle in two mexican urban centers. 16 (2), p.np. *Ecology and Society* [Online]. Available at: <http://www.ecologyandsociety.org/vol16/iss2/art11/> (Accessed 14 February 2013).
- Philip, B. (2011). Bangkok at risk of sinking into the sea. *The Guardian*, 13 September 2011.
- Phongnongsung, W. and Borchard, C. (2012). *Plan Thailand: flood response and recovery project*. Bangkok: Plan Thailand.

- Pimbert, M. and Pretty, J. (1997). Parks, people and professionals: putting 'participation' into protected area management. In: Ghimire, K. and Pimbert, M. (eds.) *Social change and conservation*. London: Earthscan Publications Limited.
- Pinder, C. (2009). *Sustainable livelihoods approaches: research findings for development policymakers and practitioners*. Brighton: ODI.
- Pongsudhirak, T. (2011). The politics behind Thailand's floods. *The Guardian*, 21 October 2011.
- Portes, A. and Landolt, P. (2000). Social capital: promise and pitfalls of its role in development. *Journal of Latin American Studies* 32 (2), pp.529-547.
- Potter, R. (2002). Theories, strategies and ideologies of development. In: Desai, V. and Potter, R. (eds.) *The Companion to Development Studies*. London: Arnold, pp.61-64.
- Pretty, J. et al. (1995). *Participatory learning and action: a trainer's guide*. London: International Institute for Environment and Development.
- Pryke, M. (1999). City rhythms: neo-liberalism and the developing world. In: Allen, J., Massey, D. and Pryke, M. (eds.) *Unsettling Cities*. London: Routledge, pp.229-270.
- Putnam, R. (2000). Bowling alone: America's declining social capital. *Journal of Democracy* 6 (1), pp.65-78.
- Putnam, R. (2007). E pluribus unum: diversity and community in the twenty-first century. The 2006 Johan Skytte Prize Lecture. *Scandinavian Political Studies* 30 (2), pp.137-174.
- Quarantelli, E. (1995). Patterns of sheltering and housing in US disasters. *Disaster prevention and management: an international journal* 4 (3), pp.45-53.
- Rakodi, C. (2002). A livelihoods approach - conceptual issues and definitions. In: Lloyd-Jones, T. and Rakodi, C. (eds.) *Urban livelihoods: a people-centred approach to reducing poverty*. Abingdon: Earthscan.
- Rakodi, C. and Nunan, F. (2002). *Sustainable urbanisation: achieving Agenda 21*. Nairobi: UN-Habitat and DFID.
- Ramalingam, R. and Knox Clarke, P. (2012). *Meeting the urban challenge: adopting humanitarian efforts to an urban world*. London: ALNAP.
- Reed, J. (2007). Maximizing aid benefits after urban disasters through partnerships with local water sector utilities. *Disaster Prevention and Management: an International Journal* 16 (3), pp.401-411.
- Reed, S. et al. (2013). "Shared learning" for building urban climate resilience - experiences from Asian cities *Environment and Urbanization* 25 (2), pp.393-412.
- Rein, M. et al. (2005). *Cross-sector partnership as a development model: theoretical constructs and historical contexts*. Cambridge: University of Cambridge.
- Renschler, C. et al. (2010). Developing the peoples' resilience framework for defining and measuring disaster resilience at the community

- scale. In: *Proceedings of the 9th U.S. National and 10th Canadian Conference on Earthquake Engineering*. Toronto, Canada, Online.
- Resilience Alliance (2007). *Research prospectus: a resilience alliance initiative for transitioning urban systems towards sustainable futures*. Online: Resilience Alliance.
- Rist, G. (2014). *The history of development*. London: Zed Books.
- Rivera, F. and Settembrino, M. (nd). *Toward a sociological framework of community resilience*. Online: Department of Sociology, University of Central Florida.
- RK11 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- RK13 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- RK15 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- RK16 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- RK20 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- RK27 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- Roachanakanan, T. (1999). *Bangkok and the second Bangkok international airport: politics of planning and development*. Doctor of Philosophy. Australian National University.
- Roi Krong Neighbourhood (nd). *Roi Krong neighbourhood before upgrading*. Bangkok: CODI.
- Roodman, D. (2012). *Due diligence: an impertinent inquiry into microfinance*. Washington, DC: Center for Global Development.
- Rostow, W. (1960). *The stages of economic growth: a non-communist manifesto*. 3rd ed. Cambridge: Cambridge University Press.
- Royal Irrigation Department (2015). *History of Royal Irrigation Department*. Online: Royal Irrigation Department. Available at: <http://www.rid.go.th/eng/history.php> (Accessed: 12 June 2015 2015).
- Royal Thai Survey Department (1968). *Historical map of Bangkok: L7017*. Bangkok: Bangkok Metropolitan Administration.
- Sanderson, D. (2009a). *Integrating development and disaster management concepts to reduce vulnerability in low income urban settlements*. Doctorate of Philosophy. Oxford Brookes.
- Sanderson, D. (2009b). *Integrating development and disaster management concepts to reduce vulnerability in low income urban settlements*. Doctor of Philosophy. Oxford Brookes University.
- Sanderson, D. (2016). Urban disaster resilience. New dimensions from international practice. In: Sanderson, D., Kayden, J. and Leis, J. (eds.) *Urban disaster resilience. New dimensions from international practice in the built environment*. New York: Routledge.
- Sanderson, D. and Knox Clarke, P. (2012). *Responding to urban disasters: learning from previous relief and recovery operations*. London: ALNAP.
- Sanderson, D. and Sharma, A. (2008). Winners and losers from the 2001 Gujarat earthquake. *Environment and Urbanization* 20 (1), pp.177-186.

- Sanderson, D. and Willison, Z. (2014). *Philippines Typhoon Haiyan response review*. London: DEC and Humanitarian Coalition.
- Saphan Mai (2004). *Saphan Mai Before Upgrading*. Bangkok: Saphan Mai.
- Satterthwaite, D. (2002). Editor's introduction: globalisation and cities. *Environment and Urbanization* 14 (1), pp.3-12.
- Satterthwaite, D. (2014). The political underpinnings of cities' accumulated resilience to climate change. *Environment and Urbanization* 25 (2), pp.381-391.
- Seeliger, L. and Turok, I. (2014). Averting a downward spiral: building resilience in informal urban settlements through adaptive governance. *Environment and Urbanization* 26 (1), pp.184-199.
- Shaw, R. (2014). *Urban Disaster Risk Reduction Framework*. Singapore: World Vision International.
- Siisiainen, M. (2000). Two concepts of social capital: Bourdieu vs. Putnam. In: *ISTR Fourth International Conference*. Dublin, Ireland, 5-8 July, 2000. Dublin, Ireland: Trinity College.
- Silverman, D. (2004). *Doing qualitative research*. London: Sage.
- Simon, D. (2002). Neo-liberalism, structural adjustment and poverty reduction strategies. In: Desai, V. and Potter, R. (eds.) *The Companion to Development Studies*. London: Arnold, pp.86-91.
- SM6 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- SM8 (2014). In: Sitko, P., ed.
- SM9 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- SM16 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes.
- SM33 (2014). In: Sitko, P., ed. Oxford: Oxford Brookes University.
- Smith, G. and Wenger, D. (2007). Sustainable disaster recovery: operationalising an existing agenda. In: Rodriguez, H., Quarantelli, E. and Dynes, R. (eds.) *Handbook of disaster research*. New York: Springer.
- Stephenson, M. (2011). Considering the relationships among social conflict, social imaginaries, resilience, and community-based organization leadership. 16 (1). *Ecology and Society* [Online]. Available at: <http://www.ecologyandsociety.org/vol16/iss1/art34/>.
- Sundaesan, S. (2008). The changing landscape of microfinance. In: Sundaesan, S. (ed.) *Microfinance: emerging trends and challenges*. Cheltenham: Edward Elgar Publishing Limited.
- Supitcha, T. (2010). *Architecture for the urban poor, the 'new professionalism' of 'community architects' and the implications for architectural education: Reflections from Thailand*. PhD. University College London.
- Suri, S. (2015). *Resilient cities for children: a strategic framework for World Vision*. Melbourne: World Vision International.
- Surjan, A., Sharma, A. and Shaw, R. (2011). Understanding urban resilience. In: Shaw, R. and Sharma, A. (eds.) *Climate and Disaster Resilience in Cities*. 1 ed. Vol. 6. Bingley: Emerald Group Publishing Limited

- Swilling, M. (2015). Towards sustainable urban infrastructures for the urban anthropocene. In: Allen, A., Lampis, A. and Swilling, M. (eds.) *Untamed Urbanisms*. Abingdon: Routledge, pp.19-32.
- Swiss Re (2013). *Mind the risk: a global ranking of cities under threat from natural disasters*. Online: Swiss Re.
- TANGO International (2012). *The resilience framework*. Online: TANGO International.
- Tanner, T. et al. (2015). *Resilience scan 2015 Q1: a review of literature, debates and social media on resilience*. London: Overseas Development Institute (ODI).
- Tarbatt, J. (2012). *The plot*. London: RIBA Publishing.
- The Government Office for Science (2012). *Foresight report reducing risks of future disasters: priorities for decision makers*. London: The Government Office for Science.
- The World Bank (2015). *Workers in the informal economy*. Online: The World Bank. Available at: <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSOCIALPROTECTION/EXTLM/0,,contentMDK:20224904~menuPK:584842~pagePK:148956~piPK:216618~theSitePK:390615,00.html> (Accessed: 8 December 2015).
- Theis, J. and Grady, H. (1991). *Participatory rapid appraisal for community development*. London: International Institute for Environment and Development (IIED).
- Thomas, D. (2006). A General inductive approach for analyzing qualitative evaluation data. 27 (2), pp.237-246. Sage: American Journal of Evaluation [Online]. (Accessed 29 January 2013).
- Travlou, P. (2007). Mapping youth spaces in the public realm: identity, space and social exclusion. In: Thompson, C. and Travlou, P. (eds.) *Open space people space*. Abingdon: Taylor and Francis, pp.71-81.
- Truong, H. (2013). *The quality of public open spaces in Hochiminh city, Vietnam*. Doctor of Philosophy Oxford Brookes University.
- Turner, B. et al. (2003). A Framework for vulnerability analysis in sustainability science. *Proceedings of the National Academy of Sciences (PNAS)* 100 (14).
- Turner, J. (1976). *Housing by people*. New York: Pantheon Books.
- Twigg, J. (2001). *Sustainable livelihoods and vulnerability to disasters*. London.
- Twigg, J. (2004). *Disaster risk reduction: mitigation and preparedness in development and emergency programming*. London: Overseas Development Institute.
- Twigg, J. (2009). *Characteristics of a disaster-resilient community: a guidance note (Version 2)*. Online: DFID Disaster Risk Reduction Interagency Coordination Group.
- Twigg, J. (2015). *Disaster risk reduction*. London: HPN.
- Tyler, S. and Moench, M. (2012). A framework for urban climate resilience. *Climate and Development* 4 (4), pp.311-326.

- U.S. Indian Ocean Tsunami Warning System Programme (2007). *How resilient is your coastal community? A guide for evaluating coastal community resilience to tsunamis and other coastal hazards*. Bangkok: Indian Ocean Tsunami Warning System Program.
- Uddin, M. (2013). Towards good urban local governance in Bangladesh: lessons learnt from Japanese local government system to overcome the challenges. *Lex Localis - Journal of Local Self Government* 11 (4), pp.933-953.
- UN-Habitat (2010). *Solid waste management in the world's cities: water and sanitation in the world's cities*. London: Earthscan.
- UN-Habitat (2013a). *Planning and design for sustainable urban mobility: global report on human settlements 2013*. Abingdon.
- UN-Habitat (2013b). *State of the world's cities 2012/2013*. New York, New York: UN-Habitat.
- UN-Habitat (2014). *Background paper for World Habitat Day*. Nairobi: UN-Habitat.
- UNDP (2010). *Disaster risk reduction, governance and mainstreaming*. New York: UNDP.
- UNDP (2015). *Sustainable Development Goals*. Geneva: UNDP.
- UNESCAP (2013). *What is good governance?* Online: UNESCAP. Available at:
<http://www.unescap.org/pdd/prs/ProjectActivities/Ongoing/gg/governance.asp> (Accessed: 21 November 2013 2013).
- UNESCAP (2014). *Bangkok 2011 flood case study*. Bangkok: UNESCAP.
- UNICEF (1987). *Adjustment with a human face*. Geneva: UNICEF.
- UNICEF UK (2013). *Climate change: children's challenge*. London: UNICEF.
- UNISDR (2005a). *Inter-agency taskforce on disaster reduction, functions and responsibilities*. Geneva: UNISDR. Available at:
<http://www.unisdr.org/2005/task-force/tf-functions-responsibilities-eng.htm> (Accessed: 10 November 2015 2015).
- UNISDR (2005b). *Summary of the Hyogo Framework for Action 2005-2015: building the resilience of nations and communities to disasters*. Online: UNISDR.
- UNISDR (2007). *Hyogo Framework for Action 2005-2015: building the resilience of nations and communities to disasters: extract from the final report of the World Conference on Disaster Reduction*. Geneva.
- UNISDR (2011). *Hyogo Framework for Action 2005-2015: mid-term review*. Geneva: ISDR.
- UNISDR (2013). *The Pacific experience in developing policy and legislation on disaster risk reduction and climate change adaptation*. Bangkok: UNISDR.
- UNISDR (2015a). *The 10 essentials for making cities resilient*. Online: UNISDR. Available at:
<http://www.unisdr.org/campaign/resilientcities/toolkit/essentials> (Accessed: 30 April 2015 2015).

- UNISDR (2015b). *Global assessment report on disaster risk reduction 2015*. Geneva: UNISDR.
- UNISDR (2015c). *Sendai Framework for Disaster Risk Reduction 2015-2030*. Geneva: UNISDR.
- UNITAR/UNOSAT (2011). *Time series analysis of Thailand flooding 2011*. Online: United Nations Institute for Training and Research
- United Nations (2015a). *The Millennium Development Goals report 2015*. Geneva.
- United Nations (2015b). *Sustainable Development Goals*. Online: United Nations. Available at: <https://sustainabledevelopment.un.org/?menu=1300> (Accessed: 8 December 2015 2015).
- United Nations Development Group (2014). *Delivering the post-2015 development agenda*. Online United Nations Development Group.
- United Nations, D. o. E. a. S. A., Population Division, (2014). *World urbanisation prospects: the 2014 revision, highlights*. New York.
- Usavagovitwong, N. et al. (2013). *Housing density and housing preference in Bangkok's low-income settlements. Urbanization and emerging population issues working paper 12*. London: International Institute for Environment and Development (IIED).
- Walker, B. et al. (2006). Exploring resilience in social-ecological systems through comparative studies and theory development: introduction to the special issue. *Ecology and Society* 11 (1), p.12.
- Walker, B. et al. (2004). Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society* 9 (2), p.np. The Resilience Alliance [Online]. Available at: <http://www.ecologyandsociety.org/vol9/iss2/art5/>.
- Wallace, D. and Wallace, R. (2008). Urban systems during disasters: factors for resilience. *Ecology and Society* 13 (1), p.18.
- Wallerstein, I. (2004). *World systems analysis: an introduction*. Durham Duke University Press.
- Wamsler, C. and Brink, E. (2014). Moving beyond short-term coping and adaptation. *Environment and Urbanization* 26 (1), pp.86-111.
- Warner, S. and Whittemore, A. (2012). *American urban form: a representative history*. Cambridge: MIT Press.
- Watts, J. (2011). Thailand seeks flood prevention plan as Bangkok clean-up operation continues. *The Guardian*, 26 December 2011.
- Webster, D. (2004). Bangkok: evolution and adaptation under stress. In: Gugler, J. (ed.) *World cities beyond the west: globalisation, development and inequality*. Cambridge: Cambridge University Press, pp.82-118.
- Weiss, T. (2000). Governance, good governance and global governance: conceptual and actual challenges. *Third World Quarterly* 21 (5), pp.795-814.
- Whitehand, J. (1987). *The changing face of cities: a study of development cycles and urban form*. Oxford: Basil Blackwell.

- Whitehand, J. (2001). British urban morphology: the Conzenian tradition. *Urban Morphology* 5 (2), pp.103-109.
- Whitehand, J. (2012). Issues in urban morphology. *Urban Morphology* (16), pp.55-65. [Online]. Available at: http://www.urbanform.org/online_public/2012_1.shtml (Accessed 24 January 2013).
- WHO and UNICEF (2014). *Progress on drinking water and sanitation 2014 update*. Geneva: WHO and UNICEF.
- WHS (2015a). *About the World Humanitarian Summit*. Online: World Humanitarian Summit (WHS). Available at: https://http://www.worldhumanitariansummit.org/whs_about (Accessed: 12 December 2015 2015).
- WHS (2015b). *Restoring humanity, global voices calling for action: synthesis of the consultation process for the World Humanitarian Summit*. Geneva: World Humanitarian Summit.
- Williams, G., Meth, P. and Willis, K. (2009). *Geographies of developing areas: the global South in a changing world*. London: Routledge.
- Willis, K. (2005). *Theories and Practices of Development*. London: Routledge.
- Winderl, T. (2014). *Disaster resilience measurements: stock taking of ongoing efforts in developing systems for measuring resilience*. Geneva: UNDP.
- Wisner, B. et al. (2004). *At risk: natural hazards, people's vulnerability and disasters*. Second ed. London: Routledge.
- Wongbusarakum, S. and Loper, C. (2011). *Indicators to assess community level social vulnerability to climate change: an addendum to SocMon and SEM pasifika regional socioeconomic monitoring guideline*. Online.
- Woolcock, M. and Narayan, D. (2000). Social capital: implications for development theory, research, and policy. *The World Bank Research Observer* 2, pp.222-249.
- World Bank (2007). *The World Bank and participation*. Online: The World Bank.
- World Bank (2010). *Climate Risks and adaptation in asian coastal megacities*. Washington DC: The World Bank.
- World Bank (2012a). *Building urban resilience: principles, tools and practice*. Washington D.C.: World Bank.
- World Bank (2012b). *Thai flood 2011: rapid assessment for resilient recovery and reconstruction planning*. Bangkok: World Bank.
- World Bank (2013). *Social analysis: participatory rural appraisal*. Online: Available at: <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSOCIALDEV/0,,contentMDK:21233809~menuPK:3291499~pagePK:64168445~piPK:64168309~theSitePK:3177395~isCURL:Y~isCURL:Y,00.html> (Accessed: 12 December 2013 2013).
- Wungpatcharapon, S. (2012). *Participation and place-making in Thailand*. Doctor of Philosophy University of Sheffield.

- Wungpatcharapon, S. and Tovivich, S. (2012a). *Baan Mankong at Klong Bang Bua and Prayong Posriprasert*. Bangkok: CODI, CAN, ACHR.
- Wungpatcharapon, S. and Tovivich, S. (2012b). *Baan Monkong at Klong Bang Bua Community Guidebook*. Bangkok: Community Organisation Development Institute, Community Act Network, Asian Coalition for Housing Rights.
- Yin, R. (2011). *Qualitative research from start to finish*. London: Guilford Press.
- Yin, R. K. (2003). *Case study research: design and methods*. 3rd ed. Thousand Oaks, California: Sage.
- Yin, R. K. (2014). *Case study research: design and methods*. 5th ed. London: Sage.
- Yunnus, M. (2003). *Banker to the poor*. London: Aurum.

Appendices

Appendix A – Key informants

1. Bang Bua Neighbourhood Key Informants

Code name	Gender	Age	Livelihood	# of family members	Date of interview
BB1	M	63	Retired	2	24 Feb 2014
BB2	F	53	Retired	2	24 Feb 2014
BB3	F	41	Unemployed	4	24 Feb 2014
BB4	M	47	Soldier	3	26 Feb 2014
BB5	F	63	Unemployed	5	27 Feb 2014
BB6	F	48	Vendor	5	27 Feb 2014
BB7	F	32	Port authority	2	27 Feb 2014
BB8	M	38	Unemployment	2	27 Feb 2014
BB9	F	63	Shop owner	2	27 Feb 2014
BB10	M	65	Shop owner	2	27 Feb 2014
BB11	F	57	Unemployed	-	28 Feb 2014
BB12	F	49	-	4	28 Feb 2014
BB13	M	70	Retired	4	28 Feb 2014
BB14	F	67	Retired	2	28 Feb 2014
BB15	M	41	Shop owner	5	28 Feb 2014
BB16	M	36	Unemployed	-	28 Feb 2014
BB17	M	45	-	-	28 Feb 2014
BB18	F	51	Daily wage earner	9	28 Feb 2014
BB19	F	42	Daily wage earner	9	28 Feb 2014
BB20	F	38	Teacher	3	23 Mar 2014

2. Saphan Mai Neighbourhood Key Informants

Code name	Gender	Age	Livelihood	# of family members	Date of interview
SM1	F	54	Beautician	4	6 Mar 2014
SM2	F	48	Manicurist	6	6 Mar 2014
SM3	F	71	Retired	5	6 Mar 2014
SM4	F	73	Vendor	5	6 Mar 2014
SM5	F	24	Hair dresser	-	6 Mar 2014
SM6	F	33	Shop owner	5	6 Mar 2014
SM7	F	65	Vendor	4	6 Mar 2014
SM8	F	60	-	2	7 Mar 2014
SM9	M	63	-	2	7 Mar 2014
SM10	F	65	Unknown	5	8 Mar 2014
SM11	F	70	Massage therapist	-	8 Mar 2014
SM12	F	52	Labourer	10	8 Mar 2014
SM13	F	20	Mother	-	8 Mar 2014
SM14	F	44	Unknown	3	8 Mar 2014
SM15	F	85	Vendor	1	8 Mar 2014
SM16	F	42	Labourer	6	8 Mar 2014
SM17	M	70	Security	-	8 Mar 2014
SM18	M	65	Ex-soldier	1	8 Mar 2014
SM19	F	20	Student	4	9 Mar 2014
SM20	M	18	Unemployed	4	9 Mar 2014
SM21	M	18	Unemployed	3	9 Mar 2014
SM22	M	60	Shop owner	7	9 Mar 2014
SM23	F	60	Labourer	4	9 Mar 2014
SM24	F	45	Labourer	6	9 Mar 2014
SM25	F	40	Lawyer	1	9 Mar 2014
SM26	F	44	Teacher	3	10 Mar 2014
SM27	M	43	Moto taxi	-	10 Mar 2014
SM28	M	56	Moto taxi	-	10 Mar 2014
SM29	M	51	Moto taxi	-	10 Mar 2014
SM30	M	47	Mototaxi	-	10 Mar 2014
SM31	M	34	Monk	-	13 Mar 2014
SM32	M	42	Monk	-	13 Mar 2014
SM33	M	70	Monk	-	13 Mar 2014
SM34	F	66	Labourer	-	13 Mar 2014
SM35	M	44	Labourer	-	13 Mar 2014
SM36	M	21	Solider	-	13 Mar 2014
SM37	M	65	Ticket taker	-	13 Mar 2014

3. Roi Krong Neighbourhood Key Informants

Code name	Gender	Age	Livelihood	# of family members	Date of interview
RK1	F	54	Retired	7	18 Mar 2014
RK2	F	74	Vendor	3	18 Mar 2014
RK3	F	15	Unemployed	9	18 Mar 2014
RK4	M	14	Unemployed	5	18 Mar 2014
RK5	M	17	Unemployed	1	18 Mar 2014
RK6	M	17	Unemployed	3	18 Mar 2014
RK7	F	74	Shop owner	3	18 Mar 2014
RK8	M	52	Factory	5	18 Mar 2014
RK9	F	30	Restaurant	10	18 Mar 2014
RK10	F	30	Restaurant	10	18 Mar 2014
RK11	F	52	Restaurant	-	18 Mar 2014
RK12	F	57	Shop owner	5	19 Mar 2014
RK13	F	60	Hairdresser	2	19 Mar 2014
RK14	F	60+	Garbage collector	-	19 Mar 2014
RK15	F	50	Housecleaner	2	19 Mar 2014
RK16	F	50	Garbage collector	-	19 Mar 2014
RK17	F	55	Landlord	-	19 Mar 2014
RK18	M	60	Gardner	2	19 Mar 2014
RK19	M	40	Unemployed	-	19 Mar 2014
RK20	M	40	Solider	4	22 Mar 2014
RK21	F	25	Unemployed	4	22 Mar 2014
RK22	M	80	Shop keeper	2	22 Mar 2014
RK23	M	85	Retired	-	22 Mar 2014
RK24	F	37	Factory	10	22 Mar 2014
RK25	M	60	Shop keeper	5	22 Mar 2014
RK26	F	60	Retired	2	22 Mar 2014
RK27	F	60	Upgrading leader	-	17 Mar 2014
RK28	M	50	-	-	19 Mar 2014
RK29	M	88	Retired	4	21 Mar 2014
RK30	M	77	Landlord	1	21 Mar 2014
RK31	M	65	Retired	4	21 Mar 2014
RK32	F	59	Landlord	2	21 Mar 2014
RK33	M	50	Company	4	21 Mar 2014
RK34	F	39	Unemployed	4	21 Mar 2014

4. Other Key Informants

Please note: names have been withheld to preserve anonymity. Where necessary, the title of the position of the person interviewed has also be withheld.

Code	Gender	Organisation	Position	Name	Date
KI1	M	UNESCO	Programme Officer	Name withheld	23 Feb 2014
KI2	M	Ministry of Interior (Office of Climate change convention, Department of Town and Country Planning and Public works)	Architect	Name withheld	18 Mar 2014
KI3	F	Asian Coalition for Housing Rights (ACHR)	Senior development worker	Name withheld	18 Feb 2014
KI4		BMA Department of City Planning	Urban planner	Name withheld	19 Mar 2014
KI5	M	King Mongkut's Institute of Technology	Professor	Name withheld	22 Feb 2014
KI6	M	Bangkok Metropolitan Administration, (BMA), Department of Water Drainage, Flood Control Center	Staff member	Name withheld	18 Mar 2014
RK7	F	CODI	Development worker	Name withheld	25 Mar 2014
KI8	M	Institute for Social and Environmental Transition (ISET)	Scientist	Name withheld	24 Feb 2014
KI9	M	Deutsche Presse-Agentur	Journalist	Name withheld	21 Feb 2014
KI10	M	Chulalongkorn University	Masters student	Name withheld	24 Feb 2014
KI11	F	BMA Department of City Planning	Urban Planner	Name withheld	20 Mar 2014
KI12	F	St. Louis College	Professor	Name withheld	18 Mar 2014
KI13	M	Domnern Somgiat &	Lawyer	Name withheld	18 Mar 2014

		Boonma Law Office			
KI14	F	CODI	Community development worker	Name withheld	11 Mar 2014
KI15	F	Lak Si District	Community Development Worker	Name withheld	10 Mar 2014
KI16	M	Lak Si District	Urban Planner	Name withheld	10 Mar 2014
KI17	F	World Vision Thailand	Position withheld	Name withheld	10 Mar 2014
KI18	F	World Vision Thailand	Position withheld	Name withheld	21 Mar 2014
KI19	F	ADPC	Position withheld	Name withheld	18 Mar 2014
KI20	M	ADPC	Position withheld	Name withheld	21 Mar 2014
KI21	F	ADPC	Position withheld	Name withheld	21 Mar 2014
KI22	M	Architects & Associates Co., Ltd.	Architect	Name withheld	18 Mar 2014
KI23	M	Habitat for Humanity Thailand	Position withheld	Name withheld	18 Mar 2014
KI24	M	World Vision East and South Asia	Position withheld	Name withheld	24 Feb 2014
KI25	M	World Vision East Asia	Position withheld	Name withheld	27 Feb 2014
KI26	F	World Vision International	Position withheld	Name withheld	26 May 2014
KI27	F	UNESCAP	Sustainable Urban Development Section	Name withheld	25 Mar 2014
KI28	M	World Vision Indonesia	Position withheld	Name withheld	18 Mar 2014
KI29	F	Aga Khan Foundation	Position withheld	Name withheld	14 May 2015
KI30	M	Sripatum University	Professor,	Name withheld	20 Mar 2014
KI31	F	Kasetsart University	Position withheld	Name withheld	18 Mar 2014
KI32	M	Cura Kai neighbourhood	Position withheld	Name withheld	2 Mar 2014
KI33	M	Bang Bua Neighbourhood	Position withheld	Name withheld	18 Feb 2014
KI34	M	Saphan Mai Neighbourhood	Position withheld	Name withheld	7 Mar 2014
KI35	M	Roi Krong	Position	Name withheld	19 Mar

		Neighbourhood	withheld		2014
KI36	F	Roi Krong Neighbourhood	Position withheld	Name withheld	17 Mar 2014
KI37	M	Lak Si District Authority	Position withheld	Name withheld	13 Mar 2014
KI38	F	Bang Khen District Authority	Position withheld	Name withheld	28 Feb 2014
KI39	M	Central government planning department	Position withheld	Name withheld	21 Feb 2014
KI40	F	World Bank	Position withheld	Name withheld	25 Feb 2014
KI41	M	World Bank	Position withheld	Name withheld	25 Feb 2014
KI42	M	World Bank	Position withheld	Name withheld	25 Feb 2014
KI43	M	World Bank	Position withheld	Name withheld	25 Feb 2014
KI44	F	OCHA	Position withheld	Name withheld	7 Mar 2015
KI45	F	Save the Children Thailand	Position withheld	Name withheld	12 Mar 2014
KI46	F	Plan Thailand	Position withheld	Name withheld	13 Mar 2014
KI47	F	Plan Asia Regional Office	Position withheld	Name withheld	13 Mar 2014
KI48	M	CODI	Position withheld	Name withheld	25 Feb 2014
KI50	F	ALNAP	Position withheld	Name withheld	14 May 2015

*Four key informants were included in the neighbourhood list and in the non-neighbourhood resi

dents list in order to protect their identity.

Appendix B – Key informant interview questions

The following questions were selected for use in semi-structured interviews.

1. Neighbourhood Key Informant Interviews Questions

1. How many people live in your family? Adults? Children? Gender?
2. What is your main job? Do you have another / second job?
3. Do you rely on the natural environment?
4. How much do you spend on food every month? School per year? House expenses/rental?
5. What skills and talents do your friends say you have?
6. Technology. Do you use the Internet? Radio? TV? Ipad? Use a smart phone or a regular phone?
7. What kind of things could cause a problem in your house / community? (Hazards)
8. Coping strategies. How did your life change after the flood – jobs, food, medical care. How did you cope? Did other people in your house change their behaviour?
9. Humanitarian assistance. What did you receive during the flood? What would you like to have received?
10. What were the top three challenges you faced during the flood?

2. Non-Neighbourhood Key Informant Interview Questions

- a) I/NGOs
- b) UN agencies
- c) Journalists
- d) Researchers / Academics
- e) Government

a.) I/NGOs

1. Define resilience, aspects of resilience. What makes urban resilience different?
2. What vulnerabilities within Bangkok were revealed by the floods?
3. (Human) How were specialist and generalist skills put to use in the community (?)?
 - What locally available skills did you use in your interventions?
4. (Social) How did you take advantage of social networks? i.e. in what way did they become a programming opportunity?
5. (Physical) What physical infrastructure did you prioritise in your resilience interventions? Why? What might you have included in hindsight?
 - How did you assist renters? Were they a different group than other community members? If so, in what ways?
 - How did you negotiate land issues?
 - How did urban planning factor in your response strategy?
6. Financial
 - Was cash programming used, and how well did it address the needs of the urban poor?
 - Were you able to build on public-private partnerships? If so, how?
 - How was the market impacted by aid delivery? Was aid sourced locally?
 - Were local markets and private sector initiatives fully supported? What more could have been done?
7. (Natural) How were natural assets protected? What does urban DRR look like in this context?

b.) UN Agencies

1. What key institutions hold responsibility for flood prevention and recovery? How did they perform? Who is not involved but should be?
2. What kind of public-private partnerships exist? How did they perform?
3. What sort of short-term measures bring about resilience in low-income neighbourhoods?
4. How would you define resilience in low-income neighbourhoods? Is it a useful concept?
5. What policies need to be prioritised most urgently? What is the role of policy in resilience?
6. What is the greatest barrier to building resilience? How should this be overcome?
7. What kinds of private-public partnerships occurred during the floods?

c.) Journalists / academics / researchers

1. What are some of the positive and negative aspects of the government's response to the 2011 floods? How was the municipal government perceived?
2. What aspect of the floods seemed to get most coverage?
3. How were low-income neighbourhoods covered in the media? What would motivate coverage of places like Bang Bua Canal and Rattanakosin?
4. What vulnerabilities and capacities did the flood uncover?
5. Did the flood response play a role in fueling the current political situation?
6. What role did technology play?
7. What agencies / institutions had the loudest voice? Which ones achieved the most?
8. How can Bangkok be better prepared for future floods?
9. Are there examples in your mind of people being stronger after the floods?
10. How will the state of emergency affect my research? What cautions should I take?
11. Is resilience a term that offers opportunity? Or, would you describe it as a buzzword?

d.) Government

1. What prevention measures were taken before the floods occurred?
2. What does the current flood plan look like? Who helped develop it?
3. How was flood information shared with the public? Through what channels?
4. How did you link with the NDMA?
5. What revisions to the plan have occurred as a result of the 2010-2011 floods? What lessons were learned?
6. Who are the most vulnerable people to the floods, and how does your plan account for them?
7. What types of assistance did the government provide? Was cash a favoured method? What are the risks associated with cash?
8. What does resilience look like to you? What are the key elements?

e.) Planners – how does planning help or hind resilience building in communities

1. How do you engage with NGOs?
2. What do you understand by resilience? Is it a helpful concept? If so, how?
3. How did you engage in the floods? What was your role? What did you do?
4. How do your activities build resilience?
5. How do you work with communities?
6. If there were no constraints to your work, what would you do?
7. What is the role of planning in building resilience?
8. What are the major barriers to community resilience, please explain?
9. In your view what do you think could be done better?
10. Does the private sector have a role? If so, how?
11. What are the best examples you've seen of flood resilience? Why?
12. What are the major challenges? Why?
13. What will happen differently for the next floods?
14. How effective is master planning for building resilience? Please explain.

f.) Businesses

1. What role can businesses play in disaster prevention and response?
2. What was your role in the flood?
3. How did you prepare?
4. Who did you assist?
5. How did you decide who and how to assist?
6. What do you plan to do next time?

Appendix C – Sample of interview transcripts

Sample 1: A Transcript of a Key Informant Interview

Timespan	Content
	<p>Key informant interview Name: (anonymous) Organisation: King Mongkut's Institute of Technology Position: Professor</p>
0:00.0 - 0:55.7	Professor: Social vulnerability sometimes lacks the ecosystem perspective, to me that depends because social vulnerability is also rooted in political ecology, which looks a lot at human and environmental interaction.
0:55.7 - 1:07.2	Pam: What does resilience mean to you?
1:07.2 - 5:10.9	Professor: We as academics are in the process to define it. We don't have a direct translated word for resilience. What I usually talk to community. I used to talk about immunity. Immunity to changes, crises, disasters. I think that captures the simple concept that the community can understand. It's helpful in academia to investigate it thoroughly. To get this concept to the community, I may not focus on this word or it's meaning but more into the elements and the process within this concept and the kind of goals we would like to achieve from the concept. For academic sector, I think it's like a brain exercise to look into fuzzy concepts to compare and contrast to see how different disciplines or stakeholders view this concept. Different disciplines from different epistemology. It's insightful but I'm also worried. The words such as sustainability, vulnerability and resilience start to be used in many ways and it can lose it's meaning. Everyone's doing work on resilience.
5:10.9 - 5:14.1	Pam: Is disaster resilience different?
5:14.0 - 5:58.1	Professor: I think it provides more focus. Resilience alone, from my understanding, includes any kind of changes. Those changes may not be disasters.
5:58.1 - 6:33.7	Pam: What kind of vulnerability was revealed by the floods?
6:33.7 - 11:27.8	Professor: I have limited experience with the Bangkok floods but I can share some things I recently discussed with community leaders from some of my limited experience in Bangkok. There's an observation from

	<p>community leaders and local authorities who work in providing aid to flood victims, which seems that the typical vulnerable people may not fully represented in Bangkok. For example, in Lai Krabang area there are groups that rely on agriculture and other groups that seem like typical urban dwellers who have jobs in town but their residences are here in compact structures like apartments. The observation from those aid supporters reflect that those who seem to be urban dwellers need demand more than those in agricultural sector. If you like we may say that those in agricultural sector, seem to have a certain character of rural lifestyle, way of life. They seem to be able to be independent, those in agricultural sector. There's another big question about rural and urban. We are still in Bangkok but we have an agricultural sector area. The livestock from my perspective, seem to have some characteristics of rural people. Most of them are people who live here for a long time, their parents and ancestors live here. They know the area, know the area is a flood plane. They have a certain experience of adaptation compared to the new comers who want an urban lifestyle, are familiar with typical urban life. From what I heard is that they have less tolerance to floods.</p>
11:27.8 - 11:50.0	<p>Pam: Do you mean that people living in urban areas demanded a higher quality of life and therefore demanded more aid?</p>
11:50.0 - 15:11.3	<p>Professor: No. I think the term higher quality or standard is also difficult. Sometimes I didn't see much as higher or lower, but different. Different ways of living. A typical example is the ones who are in agricultural sector, their residential space provides them some tolerance to floods, like houses on stilts. They have different levels. They can adapt through the changes of water level. If it gets higher they move to higher level or move their stuff to the higher level. They know how to cook, survive, sleep, travel. Some of them still have boats and they know how to operate them. Many of them told me that they closely monitor water from the north and they prepare for that ahead. What he referred to at that point was that the flood for 2010 they prepared for the incoming flood to protect their assets. They have really large fish farms. They even built up dykes before the coming floods. For some people they may have some kind of stereotype that agricultural people are poor. That might not be the case. Many are well off and have some financial power to put up some prevention.</p>
15:11.3 - 15:21.0	<p>Pam: What did the floods reveal about Bangkok in terms of preparedness and its ability to respond and recover?</p>
15:21.0 - 19:04.8	<p>Professor: I would say that it revealed ... what we observed in our studies that right now, each sector... the efforts in responding to floods mostly based on individual practice. For example, the industrial estate would like to protect their property so they put up walls and dykes to</p>

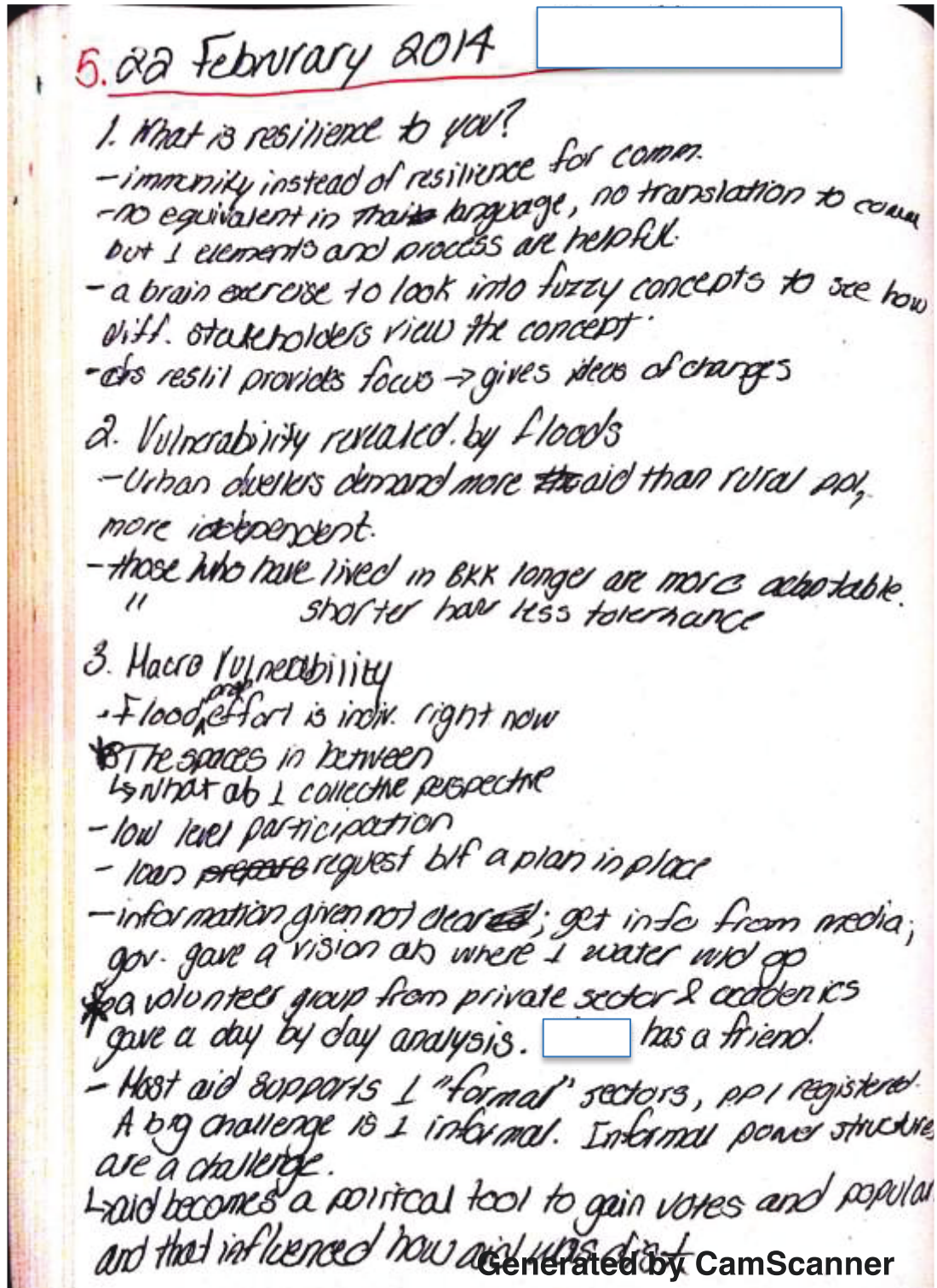
	<p>protect their property. Some households also built up walls to prevent their house from flooding, some will elevate their house and change the landscape of their house so water would not collect in their house. Our question is when each individual is doing this kind of thing, where will the water go? How about the collective perspective, which seems to me I didn't see much of that even though there's a huge project trying to do a macro level project but it's... you may have heard the news but it got very low level of participation and is still in a lot of conflict. What surprised me a lot is that they proposed for a large amount of loans even before they had a plan. I heard that some projects are still moving on. The court ordered the project owner to have higher level of participation, that's what I heard.</p>
19:04.8 - 19:19.2	Pam: Was there a flood plan in place during the 2011 floods?
19:19.2 - 19:56.4	Professor: I think that's the issue because the information at those days was pretty confused. Information given by the government and other. I think the government was also not very clear on the information so there were other sectors that tried to provide alternative information as well.
19:56.4 - 19:57.6	Pam: If I lived in Bangkok and was worried that my neighbourhood was going to flood, where would I go for information?
19:57.5 - 23:06.1	Professor: From my experience during those days we stayed pretty close with media, news - different sources. The government also came up with a vision about where the water would go, their plans. It was a long process and it changed everyday. There was a group called ... volunteers from academic, private sector to model the flood and allow Bangkok residents to give a call to get the information whether their house or neighbourhood was going to get flooded. From my perspective this was very helpful to prepare. I have a friend, he volunteered to work in that group for some sections. I may be able to put you in contact with him and he may be able to direct you to the key actors. He's working in the ministry of environment resources etc. Maybe he's also in the team that worked on the community development plan.
23:06.1 - 24:13.1	Pam: In the city land ownership is complex. How do we adapt our tools and techniques to be more suitable to the city? What are some of the social challenges in the city i.e. gangs and their networks?
24:13.1 - 27:12.3	Professor: In Bangkok and many other developing countries there are a lot of informal sectors, which usually are not officially supported. Most of the aid from the government supports official residents and communities who are officially registered in their data base. Those who are not registered, I think it's a big challenge. It will reply on, I would say, informal power structures, which also are a challenge to gauge. This is

	<p>also where political factors come in. I've heard from some aid workers that those aid become political tools as well. That some politicians take it as a tool to gain votes and popularity. It influences how these aids are distributed. The down part is that I was not part of the aid distribution so I don't have experience at hand.</p>
27:12.3 - 27:32.3	<p>Pam: Based on the political situation, is there a specific group that was more successful at getting aid?</p>
27:32.2 - 31:43.0	<p>Professor: yes, that's what I heard. It was the group that had power at that moment. It depends on which group is in power and has access to resources. Then it goes through their networks, I would say. I think you should open up to the broader network they may have. For example, the communities around here have many kinds of connections and networks, which are pretty interesting. I think to review the texture and fabric of networks and connections would be insightful. Of course, one of the networks will be linked to political parties. I heard that sometimes they have power even to channel the aid. This is the story we heard: There were two groups that needed aid. They went to one group to support and they were going to go to another group, and this group is a large political base for one politician. When the truck was about to leave this road to another group, the pump was out of work and then the floods get in. So that truck was ordered to stop going to this group to provide resources. That's what we heard. From my experience, not in Bangkok, but in the south, within the communities there could be divisions. Even to have political affiliation at the community level means a lot. For example, those who acquire the network of community leaders may have better access to resources.</p>
31:43.0 - 32:54.3	<p>Professor: I used to work with an NGO. I was there to explore green design and other environmental designs. The mission of the organisation was much broader, looking at alternative ways to life. They are more into anti-capitalism.</p>
32:54.3 - 33:41.3	<p>Pam: What about cash? Was it used? What are the risks and successes?</p>
33:41.3 - 37:18.7	<p>Professor: Yes it was used on the floods. The risks are issues of transparency. For example, my brother's house was flooded in an area that was supposed to get compensation but he's well off and didn't need that. Later he found out that someone already took the money on his behalf. We don't know who. I'm not sure about Bangkok but in other provincial floods I heard that it can be a political tool to or strategy to gain votes. This is what I've heard from those involved in aid distribution. But I also met the households who received the money and used it for future household flood prevention. They built a tall wall. I'm not sure building walls is the right thing to do but at least they used it for prevention. I've gotten great complaints from the community that aid</p>

	<p>from the government is very slow and isn't appropriate, gender or culture wise, it might not match with the needs of the people down there. I think it's a flexible kind of resource that can transfer. It's still very complex.</p>
37:18.7 - 37:28.9	<p>Pam: What about technology?</p>
37:28.9 - 44:21.3	<p>Professor: I think the modeling technology is really helpful to get information for people to prepare. One is from the macro level, the group that I mentioned. The micro level in this area, we had just a group of our faculty from engineering who do a kind of monitoring study to be able to provide information to communities around here to prepare. The response from the community is very good. As long as they know ahead what will happen, they can prepare. They use these different kinds of technologies to monitor these floods. They call it Lad Krabang model. We've got both technology from the campus and the communities to monitor the flood level. We calculate and model and provide projections to the communities. Again, I think information is critical. Many of the communities lose trust to the government information.</p> <p>Trust to the government is another key point. You can create a lot of our phenomena. You may have heard during the floods that even water is difficult to find in the department store because some people are so panicked that they bought such large amounts of water bottles that it became unavailable during those stage. Some people blame these people for being too panicked but I myself understand them because there is no precise information for them. The government says this and then many times it's not as they said. If they said you are safe, but then you are not safe. As you is a typical word that the Prime Minister usually said. It implies that we can deal with it. We can manage the floods, we can control the floods but in many cases we can't. I think I'm not surprised if people start to doubt what the government says. Most of the time is said calm down, we are okay. When we show evidence that we are not okay we wonder to what level we should take information from the government. If the government said that we are at risk in this level perhaps it could be in this level. We got a sense that the information was tamed down. When we hear something we need to start to add it up. Also there's alternate sector who provides this information as counter balance to what was said. We had many sources of information and no one could tell which information was better than the other. Then there was trust in this information. People would save their own as best they can and it came back to the individual efforts. I think it's very interesting to compare what happened in Bangkok to what happened in Japan to the earthquake and tsunami and nuclear plants. I think for Japanese they have a certain trust in their government and discipline to stay in order. Here to me it's a bit chaos. It seems to be that a lot of people who live in Bangkok find it easy to get a sense of survival, to do what ever they can</p>

	do to survive like to get as much water bottles as they can.
44:21.3 - 44:36.2	Pam: Is Bangkok ready for another large-scale flood?
44:36.2 - 49:40.7	<p>Professor: I don't know all the preparation Bangkok did, and the whole country but it seems to me no. Looking at it from a very small scale there is a programme to increase the capacity of the canal to have a better flow. But I heard from the communities that it's just a programme that the outcome is not what we expected. For example, some informants said that you may see the machine floating on the canal try to dig the mud of the canal but if the canal drops you see holes in the canals, which means that those digs occurred sparsely. It's not really levelled down to increase the capacity. No one knows what happens below the canal. One resident said that he needed to do a favour to the workers to ask them to really do the job in front of his house because he really needed to get it done. Looking at broader scale we so far see a lot of expansion of urbanised area into flood plains and wetlands. In the plan you have a plan to preserve as a green area that water can then go through. The plan sometimes has been shifted like with Subanaphomi airport. It was directly in the bottom of the flood way. Have you seen the land use plan of Bangkok? That's legally done. There are others that may not comply with the plans. I still see a lot of new developments on flood plains.</p> <p>In the plan they try to keep some flood plain that in real life is not really kept. More development is going on there.</p>

A sample of the notes taken to correspond with the interview transcript above



Appendix D – Focus group discussions

Focus Group Discussions

Code name	Type	# of people	Date
BBFGD1	Focus Group Discussion	18	21 Feb 2014
BBFGD2	Focus Group Discussion	13	2 Mar 2014
BBFDG3	Focus Group Discussion	13	10 Aug 2014

Code name	Type	# of people	Date
SMFDG1	Focus Group Discussion	8	10 Aug 2014

Code name	Type	# of people	Date
RKFDG1	Focus Group Discussion	12	10 Aug 2014

Code name	Type	# of people	Date
FGD1	World Bank Focus Group Discussion	4	25 Feb 2014
FDG2	CODI Focus Group Discussion	3	25 Feb 2014

Sample 1: Questions for FDGs

1. How did you prepare for the floods? What actions did you take?
2. What were the resources available to the neighbourhood and were they utilised?
3. Who is responsible for disaster coordination?
4. What forms of assistance were offered in this neighbourhood and how were they shared?
5. What form of assistance helped you the most? Why?
6. What were some of the ways information about the floods and flood assistance reached people in this neighbourhood? What was the most effective method?
7. What kind of technology did you use to communicate about the flood? What was the most preferred method?
8. What was your top priority when the water receded?
9. Were you able to continue doing your job? How?
10. If you were to focus on changing one thing that would offer the most stability and safety to your life right now, what would it be?
11. Are there policies you would change that would help you prevent future floods?
12. What basic functions were maintained during the floods? (i.e. access to school, access to jobs, health clinics, water, power, electricity etc.)

**Sample 2: Key Findings used for validation on 10 Aug 2014 in Bang Bua,
Saphan Mai and Roi Krong Neighbourhoods**

Physical Infrastructure (Environment, urban form, infrastructure and services)	Political Infrastructure (Civil society, government)	Economic Infrastructure (Jobs, loans, money)	Social Infrastructure (Social capital, power, leadership and decision-making)	Technical Infrastructure (Information Communication Technology - ICT)
<p>1. Identity: My neighbourhood is ... (fill in the blank)</p> <p>2. Children have more protection with the new public space for them to play in.</p> <p>3. Public buildings and community infrastructure unites residents and offers a sense of rootedness and belonging due to the permanent nature of the buildings.</p>	<p>The physical re-organisation of the neighbourhood resulted in a place that was more transparent, more accountable, trusted and inclusive.</p> <p>2. Participation is key to building trust and communication in “peace” times (i.e. through mechanisms such as savings clubs, celebrations and events), and is the foundation for an effective community response.</p> <p>3. During the flood, the way in which items were distributed and decisions made in my neighbourhood was transparent.</p>	<p>1. I needed access to a small loan after the floods in order to get back to work again.</p>	<p>1. People who fall out of favour with the community or are illegal have less protection. The community is not incentivized to protect people who break away from communal value systems.</p> <p>2. People on the edge are excluded from help.</p> <p>3. Evacuation centres hosted the most vulnerable, including: A. the elderly, sick, young children and differently abled persons; those who did not have relatives or friends they could stay with. C. Families with a one story home.</p> <p>4. People in my neighbourhood know what to do to prepare for the next big flood.</p>	<p>1. The most reliable, accurate information comes from my community leader and people in the committee.</p>

Sample 3: Transcript of a focus group discussion

Timespan	Content
0:00.0 - 0:08.7	<p>Key informant interview Name: (anonymous) Organisation: World Bank Position: Community development workers</p>
0:08.7 - 0:55.9	Pam: What is the project you are working on now?
0:55.9 - 5:17.1	<p>WB: This is the project that got support from the world bank funded by the Japanese government. The project was run 2-3 years ago. The team surveyed the affected area. We haven't yet started the programme. The target is to support the flood affected people, the urban poor and those who are ready with the system, like strengthen community. This programme is not focused on building construction. We are looking to strengthen community capacity. It's starting now. We had to make an operation manual, CODI will be the main organisation who gets the money. We call this programme the Livelihood Support for the Urban Poor. It's funded by the World Bank but implemented by CODI. Finally they agree that they are going to support five provinces in Thailand, about 3,000 households in about ten communities per province.</p>
5:17.1 - 6:47.3	Pam: What is the word used in Thailand by Thai people instead of resilience and what kind of concepts are in there?
6:47.3 - 12:23.5	<p>WB: It means flexible. We don't have this word in Thai.</p> <p>Fuen foo. We use that word. Like a recovery. After a disaster we use many words but usually fuen foo. It might not be recover better because some people after the floods might go back to their home town or cannot stay in the same place so you can't use fuen foo in their case.</p> <p>The situation that has been destroyed or collapsed from the normal life and people try to recover it back to the same position. I work in tsunami and I never see this word. It must mean recovery or reconstruction after disaster.</p>
12:23.5 - 12:47.2	WB: I think from the dictionary it says flexible.
14:09.4 - 15:08.4	Pam: What kind of vulnerabilities were revealed by the Bangkok floods? In Bang Bua if you can or in Bangkok more generally.

15:08.4 - 21:39.7	<p>WB: the urban people who are depending on the food, water etc. mainly the people who spend money to buy the products because they cannot produce it themselves. The main problem at that time. The dirty water leaked out into the drinking water supply. It means that the people who depend on the main infrastructure of the city are the main ones affected because the road is blocked and no one can send the food from the rural area, not even eggs or vegetables. This really affected people in Bangkok. The second is the urban poor group who are the people who are working day by day. Earning money for each day to survive. Like a street vendor who has to sell food to earn money. Those people are the most affected because they couldn't go out for work and there was little opportunity to go out and find money. This contrasts with the middle class who are working in the office or have monthly income. They are not affected much. They might go to other provinces and work from the Internet.</p> <p>He mentioned the same point that the low income group that earns daily wages are the most affected.</p>
21:39.7 - 21:56.2	<p>Pam: What is the World Bank proposing to do in Bang Bua with this project?</p>
21:56.2 - 25:27.8	<p>WB: for this programme it might not be clear yet but up until now our process is selecting the target area and it is not decided yet if Bang Bua will be one of the communities.</p> <p>Pam: Will disaster preparedness factor in your programmes?</p> <p>WB: Yes, the flooding will come every year. This programme is adaptation and ? We try to protect and recover the affected area. The process is to select the area then design the project.</p>
25:27.8 - 25:42.9	<p>Pam: How do you do urban disaster preparedness?</p>
25:42.9 - 32:23.0	<p>WB: Facebook. The urban poor are using Facebook. The quickest way to get real time information is from Facebook. The information from the government may not be real.</p> <p>Pam: Who do you believe when you read facebook.</p> <p>WB: During the floods...it was the fastest way to update information. Not only the general people used this application. The celebrities and famous reporters used it. When they went to the area they easily update the situation. When they went to</p>

	<p>distribute the life savings kit they mainly go to the community area, not to the people who live in the condos or big houses. The possibility to update info about when and where they are going to start giving food was possible. The volunteer group formed a group and opened a page. People interested joined. They could give if they wanted. This is the group from CODI so they already have a connection with the community leader. It's easier for them to have a call and manage how to distribute to each area. The people in the community, teenagers in the poor communities also use Facebook. For 2,000-3,000 it's possible to buy a phone that can access Facebook. It's possible to show you some FB of the community leader.</p>
32:23.0 - 32:38.1	<p>Pam: What lessons have we learned from the Bangkok floods?</p>
32:38.1 - 42:37.7	<p>WB: It's obvious that the case of the flooding shows the lack of management between the government and the needs of the people. For example, the life savings bag, every bag is the same with sardines in the can, instant noodles. The people who are in that area have to survive with that kind of food for more than a month. Sometimes it's possible to change... they think this is the way to deal with the problem. But if they had a better management system we can adapt those affected people in the same table with a more proper plan to help them. It would be better. The case of the food is just the example.</p> <p>Pam: Do you mean that the government has to speak or interact more with the community and together they should make a plan?</p> <p>WB: Yes. It's easier to contribute but something might not fit with the needs of the receiver. It's easier to give things but those things might not be the things people need. In Thailand we have a variety of food, our areas can produce a lot of food. In this case the bag from the helpers gave the same thing all over the affected area. It show they are not improve in the negotiation, plan. People have to think more and distribute better variety of food. And not only food. Use local products and let the local people be the main actors to do this kind of thing because the central government is central to deal with the central problems but if you see another side the local government / people it's possible to run and manage this kind of thing by itself, ie. set up a kitchen for the whole area.</p> <p>Have you seen the news that the Don Muang is the government place to store dry goods for people all over the country but it was flooded. The other important thing is that Bang Bua is very</p>

	close to Don Muang, yet the things from the Don Muang didn't get sent to Bang Bua.
42:37.6 - 54:20.4	<p>Pam: So lesson 1 is better coordination with the community, right?</p> <p>2. Locally driven response. Meaning the planning, food distribution etc. should happen at the local level with some support from the government. According to the Thai policy, the disaster has to happen first and then the money distributed. In this case I have experience from Nakonsawan. The info came from the mayor. I.e. you have to see the water before you can distribute the sand bags. This is quite a big issue. A ministerial issue. The way to solve this is to let the local people and authorities deal with this problem by themselves.</p> <p>Pam: So what if we change the policy to release money before the water comes. Is that good?</p> <p>WB: the plan is okay. Disbursement is the problem. So cities disperse the money before the disaster happens. They have been cities to go to court over that case to get the money back. In terms of Bangkok it's possible to disperse the money and solve the problem by themselves because Bangkok has the money. In Bangkok we have the BEST which is a team to prevent the flood situation. There is a team to control and plan the opening and closing of the canal in Bangkok for each canal.</p> <p>City development funds help CDF is a fund that helps communities in disaster preparedness. They used the money in the flood situation to cook the food, buy some boats.</p>
54:20.4 - 54:45.2	Pam: How do urban planners work together with NGOs? Or should they?
54:45.2 - 59:52.9	<p>WB: It has a network to deal with disasters. With many people from the community side and from the government side and the media to work together to deal with the flood as a forum. They can have a TV programme to raise discuss the problems on the TV show. That TV programme has been started with the flood and it has continued up until now. After the discussion from the TV show is it possible to implement? After the floods finished the situation was not a hot issue any more so there are no plans. TV show is called Early Warning. (Thuen Pie). or Alert / Warning.</p> <p>(No urban planners in the room.) We are community development workers. One is finance.</p>

59:52.9 - 1:00:09.3	Pam: If you could change anything or do anything next time there is a flood, what would you change?
1:00:09.3 - 1:14:47.2	<p>WB: We always have two ways to support, one from the government and one from the volunteers. In terms of the volunteers it's faster and you can do more than the government. People can directly go to the affected people. The flood in the rural areas they needed water. In Bangkok the houses flooded so it requires a plan. They should have a plan to protect from flooding in Bangkok. Two problems is that there was too much water and sea level rise. The real problem is the bad management and releasing water from the damn.</p> <p>WB: I work on the CDF and I see those funds really help people when there is a disaster. *** Need to follow up with Om on this.</p>

A sample of the notes taken during the FGD

