Building general resilience in preparation for unexpected risks

Applying Complex Systems Thinking to Disaster Risk Reduction

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"Because resilience may not be obvious without a whole-system view, people often sacrifice resilience for stability, or for productivity, or for some other more immediately recognizable system property."

Donella Meadows
MIT scholar and book author, 1941-2001
p. 77, Thinking in Systems: A primer (2008)

Abstract

This thesis investigates the application of Complex Systems Thinking (CST) to Disaster Risk Reduction (DRR) strategies in order to build resilience in preparation for unexpected risks.

The increasing uncertainty and hyper-connectivity in world networks means that the exposure to unexpected risks is rising. National and international DRR strategies have been shown to be insufficient to move countries, states, communities and individuals to prepare in a more responsible way.

Complex Systems Thinking offers a holistic understanding of a disaster in time and space, while appreciating the uncertainty involved in risk management. However, its operationalisation is encountering numerous difficulties because of the reductionist model on which DRR strategies are formulated. This thesis argues that these efforts need to be complemented with systemic methods that may overcome the hierarchical structures in which current DRR strategies are conceived and implemented. This requires systems to develop the ability to be ambidextrous, that is, to keep current DRR structures in place while extending their range to include unexpected events for which no prescribed actions exist. The question arises, how should this be done?

The portfolio of papers and commentary that comprises the substance of the thesis addresses these thematic questions in an integrated way. Taken together, they advance the core argument of the thesis, which is that CST

offers an alternative approach to moving from a reductionist to an ambidextrous mindset; this will enable DRR practitioners to 'think outside the box' and to take better account of the complex systemic conditions in which disasters develop.

Paper 1 shows how disasters are characterised by interacting systems that need to develop the capability to adapt and to be flexible beyond predefined frameworks and regulations in order to be better prepared to face uncertainty. Paper 2 highlights that disaster risk reduction operates at the interface between knowable and unknown risks and, for this reason, reductionist and systemic approaches to disaster risk reduction need to be integrated. In Paper 3, these concepts are juxtaposed with the concept of resilience in the Australian context and three scales of enquiry are presented: (1) members of the public from two South Australian councils, (2) the Australian Red Cross and (3) the South Australian Government organisations that are responsible for DRR.

The concept of resilience is further explored in a conceptual framework in Paper 4, where the overall methodology adopted in this thesis is illustrated. Current DRR strategies are overbalanced towards mitigation of identified risks, but neglect to take into account that disasters are largely unexpected events.

'What is preventing communities and institutions from developing a culture of safety and resilience?' Paper 5 addresses this question on an international level and suggests that interdependencies between strategic priorities need to be taken into consideration, if international targets are to be met.

Paper 6 provides an overview of the South Australian DRR context and an integrated cross-scale perspective of potential and systemic constraints that act as barriers to change. Finally, Paper 7 summarises the state of the art of DRR at the South Australian level and suggests possible ways forward.

The final chapter includes key insights and recommendations, while introducing future research steps.

Keywords: Disaster Risk Reduction (DRR), prevention, mitigation, System of Systems (SoS), Complex Systems Thinking (CST)

Preamble

Foreword

This thesis is about resilience and disaster risk reduction. It concerns itself with strategy and common good, risk management and long-term thinking. It offers disaster risk reduction practitioners and academics a new way of seeing the phases of preparation before a disaster is perceived. In particular, it challenges the way uncertainty is tackled in western societies and proposes a new way of thinking rooted in complexity and systems theories.

But how did it all start?

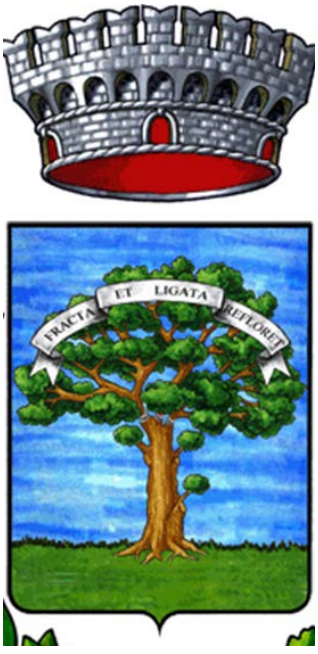

Figure 1.1. Particular of coat of arms of Lizzano. Authorised by Benito Mussolini in 1929.

Resilience has been a background theme for a long time. I originally come from Lizzano, a small town in Southern Italy. Lizzano's coat of arms is an oak tree and among its branches, it reads 'Fracta et ligata refloret', which, translated from the Latin, means 'broken and tied it flourishes'. Legend says that during a storm, the most majestic oak in town was violently struck by the fury of the wind, which caused the two main branches to drop. During the storm the castle, being the safest refuge, had opened its doors to all the people living around the town.

After the storm, the community did not give up on the broken tree and decided to tie the branches to the trunk. Their efforts were rewarded when finally the oak, almost magically, flourished more beautifully than before. The tree became a symbol of resilience. Those in the community had taken care of one another and of their valued tree. The story offers a profound metaphor for the care of human beings for their environment (back then people knew that they were highly dependent on the resources of the land, being primarily farmers).

The message conveyed in this story is powerful: "broken and connected, it now flourishes". I have often contemplated these words and sensed their profound and open meaning, which pervades this thesis.

About the author

My background has influenced the development of this thesis, representing at times strength and at times risk of bias. For this reason, I declare it to the reader here as a matter of transparency.

I have worked in a number of corporate businesses across Italy, Germany, France and Australia, mainly in project and risk management related positions. In 2010, I authored the book 'Risk Management in Complex Projects. An exploratory study to managing unknown unknowns in uncertain environments' published by LAP. I hold a Bachelor degree in Logistics and Production Engineering from the Politecnico di Torino / Free University of Bolzano (Italy) and a Master in Business Engineering from the Karlsruhe Institute of Technology (KIT, Germany).

I am co-founder and board member of the *Sferracavalli| International Festival of Sustainable Imagination* (Italy), Co-Chair of the South Australian Covenanting Committee (reconciliation between Australian First and Second Peoples), board member of the National Voluntary Service Strategic Reference Group of the Australian Red Cross and a volunteer in Emergency Services for the Australian Red Cross.

In the latter role as an Emergency Services volunteer for the Australian Red Cross in South Australia, I have been activated multiple times during heat waves and bush fires between 2012 and 2015, both at the headquarters of the Australian Red Cross, in relief centres and out in the field, to provide support to disaster survivors.

Acknowledgments

When starting to read a book or a thesis, I normally read the acknowledgements because they give me an indication of what it takes to put together the document that I am about to read. It is in that spirit and with gratitude that I write the following.

I acknowledge the financial support of the University of Adelaide through the Adelaide Scholarship International (ASI). In addition, the Australian Commonwealth Government and the South Australian Fire and Emergency Service Commission (SAFECOM) provided financial support (Grant no. NDRP-1213-33) and generous advice during the PhD journey.

Research participants supported this study by volunteering their time and contributing their insights and expertise. I wish to thank: the community members and staff of Community Safety at the City of Onkaparinga; the community members and staff of Emergency Management at the Adelaide City Council; the Australian Red Cross – Emergency Services; the SA Police; the SA Metropolitan Fire Services; the SA Country Fire Services; Safework SA; the SA Department of Environment and Water; the State Emergency Services; Primary Industries and Regional SA; the SA Department of Health and the Department for Planning, Transport and Infrastructure. Thank you.

I am thankful to both my supervisors for believing in me, in my research and stakeholder engagement skills.

I am thankful to my principal supervisor, Professor Vernon Ireland, for initiating me into Complex Systems Thinking and giving me the freedom to explore its application to Disaster Risk Reduction.

My deep gratitude goes to my co-supervisor, Dr. Barry Elsey, for supporting and encouraging me in developing my own critical thinking, for believing in me while questioning my assumptions, thus helping me to sharpen them. I shall always treasure your teachings about life and academia.

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Thanks to Dr. Robyn Groves, who helped me to express my thoughts in English and assisted with proofreading this thesis. During the last 3 years, I spent long hours sitting at a desk without having any back problems. The merit is Ms. Michelle Langman's – thanks for your wise advice and fun pilates classes.

I thank my family in Italy and Australia for their support and enthusiasm for my research topics. Your positivity and warm attitude helped me endure in the journey and feel at home in this far away country.

Thanks to all the friends that supported me by asking clever questions, proofreading my writing, listening to my complex thoughts, and continuing to be my friend.

Finally, thanks to Rowan who supported me in every possible way, including by solving mysterious formatting issues, cooking, cleaning, proof-reading, listening, and cheering me up. You helped me see this PhD as part of a much bigger journey, that is, life. Thank you.

To the people living in the uncertainty of today

Table of Contents

List of Figures

List of Tables

Abbreviations

ARC Australian Red Cross

CEDIM Centre for Disaster Management and Risk Reduction Technology

CFS Country Fire Services

CST Complex Systems Thinking

DEWNR Department of Environment, Water and Natural Resources

DPTI Department of Transport, Planning and Infrastructure

DRR Disaster Risk Reduction

GAR Global Assessment Report

HFA Hyogo Framework for Action 2005-2015

HL Hazard Leader

KIT Karlsruhe Institute of Technology

MFS Metropolitan Fire Services

NERAG National Emergency Risk Assessment Guidelines

NSDR National Strategy for Disaster Resilience

OECD Organisation for Economic Co-Operation and Development

OSCE Organisation for Security and Co-operation in Europe

SAFECOM South Australian Fire and Emergency Service Commission

SA South Australia (n)

SAPOL South Australian Police

SEMP State Emergency Management Plan

SES State Emergency Services

SMAG State Mitigation Advisory Group

SoS System of Systems

SoSS System of Subsystems

UN United Nations

UNISDR United Nations Office for Disaster Risk Reduction

ZERMC Zone Emergency Risk Management Committee