

CRN REPORT

Focal Report 6

Risk Analysis

Resilience – Trends in Policy and Research

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Crisis and Risk Network (CRN)
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Purpose: As part of a larger mandate, the Swiss Federal Office for Civil Protection (FOCP) has tasked the Center for Security Studies (CSS) at ETH Zurich with compiling 'focal reports' (Fokusberichte) on critical infrastructure protection and on risk analysis to promote discussion and provide information about new trends and insights.

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1. INTRODUCTION

The Task

The analysis and evaluation of risks and threats relevant to the civil protection system is among the key responsibilities of the Swiss Federal Office for Civil Protection (FOCP). As part of a larger mandate, the FOCP has tasked the Center for Security Studies (CSS) at ETH Zurich with producing two annual ‘focal reports’ (Fokusberichte) on risk and vulnerability analysis.

According to this mandate, the focal reports are compiled using the following method: First, a ‘scan’ of the environment is performed with the aim of searching actively for information that helps to expand and deepen the knowledge and understanding of the issue under scrutiny. This is a continuous process that uses the following sources:

- ◆ Internet Monitoring: New and/or relevant publications and documents with a focus on risk and vulnerability analysis are identified and collected.
- ◆ Science Monitoring: Relevant journals are identified and screened, and relevant articles evaluated.
- ◆ Government Monitoring: Policy documents with relevance to Switzerland from various countries and from international inter- and non-governmental organizations are identified.

Second, the material thus collected is filtered, analyzed, and summarized in the focal reports. Previous focal reports can be downloaded from the website of the Crisis and Risk Network CRN at <http://www.crn.ethz.ch>.

This particular focal report draws mainly on the insights gained at the International Symposium on Societal Resilience that took place from 30 November to 2 December 2010 in Washington, D.C.¹ The symposium brought together academics and public officials from around the world. One of the aims of the symposium was to foster collaboration within the International Resilience Research Network, an initiative to encourage dialogue and share research in the field of societal resilience.

¹ The presentations of all speakers at this symposium can be downloaded from the Symposium website: <http://www.homelandsecurity.org/issrvids/International%20Symposium%20on%20Societal%20Resilience-2010.htm>. <https://www.signup4.net/Public/ap.aspx?EID=HOME58E>.

The Structure of this Focal Report

The sixth focal report focuses on resilience. It looks at the way selected countries define and use resilience in the area of national security, and analyzes some recent efforts to come up with metrics and measurements to assess resilience.

Resilience is currently much in vogue and is increasingly making its way into the domain of (national) security. However, the concept did not originate in security, but was imported from the disciplines of ecology² and engineering. The popularity of the resilience concept among security experts is closely linked to the emergence of a world of risks rather than threats: Facing a variety of different risks – from natural hazards and the failure of critical infrastructures to terrorist attacks – policy-makers have recognized that not all disasters can be averted, and security can never be fully achieved. As a consequence, the focus has shifted from averting, deterring, and protecting from threats to mitigating the consequences should a disaster occur. In this context, the concept of resilience offers an apt metaphor of how communities can resist damage and recover quickly from adverse events.³

In the most general sense of the concept, being resilient is to be able to “bounce back” after a disturbance. Beyond that, however, there is no consensus on what resilience means, which is due to the fact that resilience has been and continues to be used in various academic disciplines and in different policy areas (critical infrastructure protection, emergency management, counterterrorism, etc.). The most recent trend in resilience seems to involve operational-

izing resilience in order to translate the concept into practice.

The report at hand is structured as follows:

- The first part presents the results of the government monitoring: Recent policy documents from selected countries were analyzed focusing on definitions, relevance, and impact on government programs.⁴
- The second part looks at recent attempts to assess and measure resilience both in academia and in national security policy. It presents and discusses a number of “pilot projects” to develop resilience indices, identifies the promises and pitfalls of measuring resilience, and discusses the prospects for further progress in this area.
- The third part draws on the insights of the two previous parts to discuss possible lessons for Switzerland.
- The report concludes with an annotated bibliography on resilience, including government documents, online resources, and academic literature.

2 Most famously C. S. Holling’s work on the stability of ecosystems, see Holling, C.S. (1973). *Resilience and stability of ecological systems*. *Annual Review of Ecology and Systematics* 4, pp. 1–23.

3 Norris, F.H. et al. (2008). *Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness*. *American Journal of Community Psychology* 41(1–2), pp. 127–150.

4 The countries selected for this focal report are the United States, the United Kingdom, Australia, Canada, Germany, Singapore, and Israel.

2. RESILIENCE: CURRENT TRENDS IN POLICY

This section analyzes the use of the concept of resilience in the official, central government-level policies of various countries. Where available, key policy documents are the focus of the analysis (see Fig. 1). The section answers the following three questions:

- 1) How is resilience defined in each country?
- 2) In which areas of national security policy is the concept of resilience used?
- 3) Are there any government projects intended to transform the concept into hands-on programmatic efforts?

Accordingly, resilience is analyzed separately in each country under the headings *Definition*, *Relevance*, and *Impact on government programs*.

The second part of this section compares and contrasts the findings and analyzes to what extent the conceptualization and practice of resilience are similar in the selected countries.

Key national security documents

United States	National Security Strategy, 2010
	Enhancing Critical Infrastructure Resilience, 2010
	Presidential Policy Directive PPD-8: National Preparedness, 2011
	National Infrastructure Protection Plan (NIPP), 2009
	National Response Framework, 2008
	FEMA Strategic Plans, 2008-2013 and 2011-2014
United Kingdom	National Security Strategy, 2010
	Strategic Framework and Policy Statement on Improving the Resilience of Critical Infrastructure to Disruption from Natural Hazards, 2010
	Civil Contingencies Act, 2004
	Emergency Preparedness: Guidance on Part 1 of the Civil Contingencies Act, 2004
	Strategic National Framework on Community Resilience, 2010
Australia	First National Security Statement to the Parliament. Address by the former Prime Minister, 2008
	Counter-terrorism White Paper, 2010
	Critical Infrastructure Resilience Strategy, 2010
	National Strategy for Disaster Resilience, 2011
	National Disaster Resilience Framework, 2010
	Building Inclusive and Resilient Communities, 2009
Assessing Resilience and Vulnerability in the Context of Emergencies: Guidelines, 2000	

Canada	National Security Policy, 2004
	National Strategy for Critical Infrastructure, 2009
	Action Plan for Critical Infrastructure, 2009
	An Emergency Management Framework for Canada, 2011
	Federal Policy for Emergency Management, 2009
	National Disaster Mitigation Strategy, 2008
	Emergency Management Planning Guide, 2010–2011
	Federal Emergency Response Plan, 2009
Germany	Chemical, Biological, Radiological, Nuclear and Explosives Resilience Strategy for Canada, 2011
	Nationale Strategie zum Schutz Kritischer Infrastrukturen (KRITIS-Strategie), 2009
	Schutz Kritischer Infrastrukturen – Basisschutzkonzept, 2005
	Schutz Kritischer Infrastrukturen – Risiko- und Krisenmanagement (Leitfaden für Unternehmen und Behörden), 2008
	Neue Strategie zum Schutz der Bevölkerung in Deutschland, 2010
Singapore	Strategie für einen modernen Bevölkerungsschutz in Deutschland, 2009
	National Security Strategy, 2004
	Infocomm Security Masterplan, 2008
	Total Defence: Protecting the Singaporean Way of Life, 2010
Israel	Civil Defence Emergency Handbook, 2010
	Website of the Home Front Command and secondary literature

Fig. 1: Key national security documents of selected countries.

2.1 Resilience definitions and government programs

United States

Definition:

The US government officially defines resilience as the “ability to resist, absorb, recover from or successfully adapt to adversity or a change in conditions.”⁵ There is also an “extended definition”:

“1) ability of systems, infrastructures, government, business, and citizenry to resist, absorb recover from, or adapt to an adverse occurrence that may cause harm, destruction, or loss of national significance

2) capacity of an organization to recognize threats and hazards and make adjustments that will improve future protection efforts and risk reduction measures.”⁶

Thus, resilience in the US concerns both physical entities (systems, infrastructures) and society (citizenry).

Relevance:

The term “resilience” permeates many important policy documents issued by the Department of Homeland Security (DHS) under President Barack Obama. Used and defined by the DHS, the term is firmly placed in the areas of homeland security and CIP policies. While the words “resilience”, “resiliency”, or “resilient” do not occur once in the US National Strategy

5 Department for Homeland Security (2008). *DHS Risk Lexicon*, p. 23–24.

6 Ibid.

for Homeland Security 2002,⁷ the terms can be found 18 times five years later in the strategy’s update,⁸ and 26 times in the DHS’s National Security Strategy 2010.

There is an awareness of the concept already in the 2002 strategy: The proposal to “eliminate the ‘crisis management’ and ‘consequence management’ distinction” is an indication that “consequence management” becomes an integral part of a required “single all discipline incident management plan”.⁹ Five years later, the strategy paper and the “National Response Framework” (2008) both describe resilience as a desirable state for CI. In September 2008, resilience was referred to as “one of the top ten challenges facing the next Secretary of Homeland Security”¹⁰. Consequently, the “National Infrastructure Protection Plan 2009” (NIPP) was subtitled “Partnering to enhance protection and resiliency”. Its

first sentence: “The overarching goal [...] is to: Build a safer, more secure, and more resilient America [...]”¹¹ “Strengthen[ing] security and resilience at home” is one of the National Security Strategy’s¹² central goals. The same is true for the NIPP: The term occurs 85 times in the policy paper. Resilience is closely incorporated into the “risk management process”: “CIKR [critical infrastructure and key resources] owners and operators (public or private sector) are responsible for protecting property, information, and people through measures that manage risk to help ensure more resilient operations.” NIPP’s risk management process is divided into six phases in order to ensure a continuous improvement of the level of CIP protection. The phases are: “Set goals and objectives” – “Identify assets, systems, and networks” – “Assess risks” – “Prioritize” – “Implement protective programs and resiliency strategies” – “Measure effectiveness” (see Fig. 2).

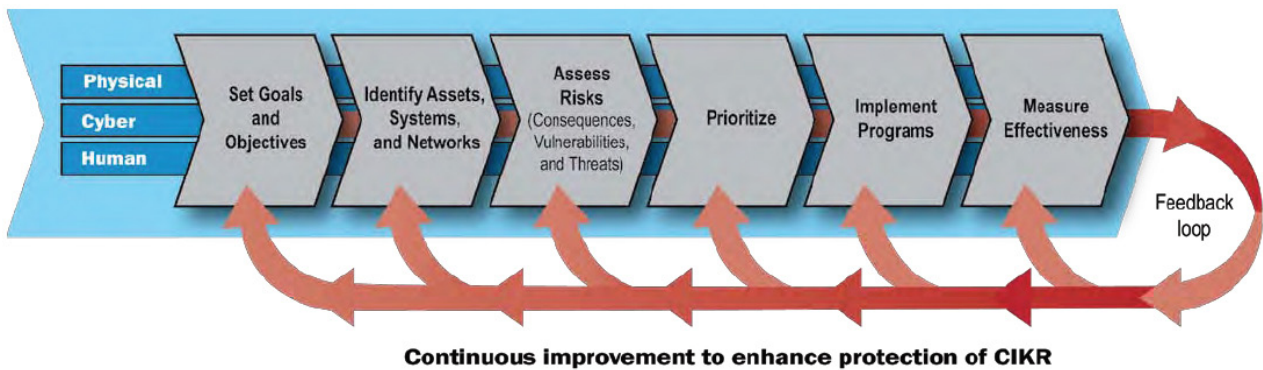


Fig. 2: NIPP Risk Management Framework¹³

7 Office of Homeland Security. *National Strategy for Homeland Security 2002*.

8 Homeland Security Council *National Strategy for Homeland Security 2007*.

9 *National Strategy for Homeland Security 2002*, p. 41–42.

10 US Department of Homeland Security, Advisory Council (2008). *Top Ten Challenges Facing the Next Secretary of Homeland Security*. Washington, DC, pp. 11f.

11 Department for Homeland Security (2009). *National Infrastructure Protection Plan 2009: Partnering to enhance protection and resiliency*, p. 1.

12 *National Security Strategy 2010*, p. 18.

13 Department of Homeland Security (2009). *National Infrastructure Protection Plan 2009: Partnering to enhance protection and resiliency*, p. 4.

Impact on government programs:

Since traditional, object-based CIP methods are central to the proposed resilience-enhancing strategies, it might be tempting to conclude that resilience is merely a buzzword. This conclusion misses the mark, though: The development of specific programs takes time. Two specific resilience programs have already been developed in the area of CIP: One is the DHS’s Regional Resiliency Assessment Program (RRAP). The voluntary program “evaluates critical infrastructure ‘clusters,’ regions, and systems to reduce the nation’s vulnerability to all-hazard threats by coordinating efforts to enhance CIKR resiliency and security across geographic regions”.¹⁴ A second program is the Voluntary Private Sector Preparedness Accreditation and Certification Program (PS-Prep),¹⁵ a public-private partnership (PPP) that certifies entities that meet the DHS’s CIP preparedness standards. “The three standards of PS-Prep”, according to the DHS, “go right to the heart of resilience, addressing organizational preparedness, and emergency and business continuity.”¹⁶ However, the DHS acknowledges that more needs to be done: “We also know that this handful of programs is not enough. Accordingly, the Resilience Initiative is, in part, focusing on developing further efforts that support rapid recovery of critical infrastructure [...]”¹⁷

Social resilience is explicitly addressed in the area of emergency management. By supporting PPPs and helpers on the local level, the Federal Emergency Management Agency’s (FEMA) Strategic Plan 2008–2013 aims to strengthen social resilience: “The actions taken before an event happens largely influence the resiliency of individuals, businesses, and communi-

ties after a disaster.”¹⁸ The plan’s update goes further: “First, FEMA must strengthen the Nation’s resilience to disasters. FEMA must enable individuals, families, and communities to withstand disruption.”¹⁹ FEMA has specific information programs in order to strengthen social resilience to disasters and emergencies: For the general public,²⁰ schoolchildren and teachers,²¹ and also for business owners.²²

The coming years will see the establishment of more hands-on resilience enhancing programs in the US. Most importantly, Presidential Policy Directive PPD-8, “National Preparedness”,²³ of 30 March 2011 calls for the “development of a national preparedness goal” within the next 180 days (p. 1–2) and the creation of a “national preparedness system” to be submitted and described within the next 240 days (p. 2–3). The president’s explicit goal for these measures is “strengthening the security and resilience of the United States through systematic preparation for the threats that pose the greatest risk to the security of the Nation, including acts of terrorism, cyber attacks, pandemics, and catastrophic national disasters.” The term “national preparedness” is defined as “actions taken to plan, organize, equip, train, and exercise to build and sustain the capabilities necessary to prevent, protect against mitigate the effects of, respond to, and recover from those threats that pose the greatest risk to the security of the Nation” (p. 5).

Clearly, the US preparedness goal and system represent a new effort in national Security, CIP, and emergency management targeted at making the US more

¹⁴ [Regional Resilience Assessment Program](#).

¹⁵ [Voluntary Private Sector Preparedness Accreditation and Certification Program \(PS-Prep\)](#).

¹⁶ Department of Homeland Security (2002). [Enhancing Critical Infrastructure Resilience](#).

¹⁷ Ibid.

¹⁸ Federal Emergency Management Agency (2008). [FEMA Strategic Plan, Fiscal Years 2008–2013](#), p. 18.

¹⁹ Federal Emergency Management Agency (2011). [FEMA Strategic Plan, Fiscal Years 2011–2014](#), p. 5.

²⁰ [Ready America](#).

²¹ [Ready Kids](#).

²² [Ready Business](#).

²³ The White House (2011). [Presidential Policy Directive/PPD-8, Subject: “National Preparedness”](#).

resilient. Because this new directive has just been published, the nature and impact of these future policy instruments cannot yet be estimated.

United Kingdom

Definition:

The UK government officially defines resilience as the “[a]bility of the community, services, area or infrastructure to detect, prevent, and, if necessary to withstand, handle and recover from disruptive challenges”.²⁴

This broad definition understands resilience as concerning both physical entities (services, infrastructure) and society (community). Also, resilience here is not only described as a quality that comes into play once a “disruptive challenge” actually happens (withstanding, handling, and recovering): It is also understood as a process that includes the detection and prevention of potential risks.

Relevance:

In the United Kingdom, the concept of resilience is firmly established in the areas of National Security, emergency management, CIP, and community resilience. The main agency for national emergency preparedness, response, and recovery by the Civil Contingencies Secretariat²⁵ is called “UK Resilience”.²⁶ UK Resilience offers public information and programs for all public protection practitioners, encompassing

areas from National Security, government, local government, CIP, and more.

The “Civil Contingencies Act 2004”²⁷ made resilience a top priority for UK emergency responders. In the “Guidance” to the act, the importance of resilience is elaborated in detail. Category 1 responders (police, fire services, emergency medical services, etc.) and Category 2 responders (key private sector supporting responders such as transport, gas and electricity providers, communication services, etc.) responsible for carrying out the legislation must establish Local Resilience Forums (LRFs). These PPPs are “the principal mechanism for multi-agency cooperation”.²⁸ LRFs are responsible for collectively planning and communicating emergency plans, including resilience strategies such as establishing area-specific risk and response profiles and “the planning for continuity management”.²⁹ LRFs must meet at least twice a year. By 2011, “a total of 42 LRFs have been established and serve communities defined by the boundaries of Police Areas across England and Wales.” Their mandatory duties include “integrating resilience into day-to-day work; and at every tier – individual, team, organizational, bilateral, multilateral, local, sub-national and national”.³⁰ Accordingly, the concept of resilience is also the main national priority outlined in the “The National Security Strategy” (2010): “ensuring a secure and resilient UK – protecting our people, economy, infrastructure, territory and way of life from all major risks that can affect us directly [...]”.³¹

24 Cabinet Office (2011). *Lexicon of UK Civil Protection Terminology, version 2.0.1*.

25 Created in 2001, the Civil Contingencies Secretariat (CCS) is the department of the British Cabinet Office responsible for national emergency planning.

26 *UK Resilience*.

27 This Act of the UK Parliament established a coherent framework for emergency planning and response ranging from the local to the national level, see *Civil Contingencies Act 2004*.

28 *Emergency Preparedness: Guidance on Part 1 of the Civil Contingencies Act 2004, its associated Regulations and non-statutory arrangements* (2005).

29 *Ibid.*, p. 11.

30 Civil Contingencies Secretariat (2011). *The role of Local Resilience Forums: A reference document*, p. 6

31 HM Government (2010). *The National Security Strategy*.

Impact on government programs:

The broadness of the term “resilience” (people, economy, infrastructure, territory, and way of life) is mirrored in its application by UK government entities in all areas. Hands-on, practically oriented resilience-enhancing programs are in use both in CIP and with regard to societal resilience. The Cabinet Office’s “Capabilities Programme”, “the core framework through which the UK government is seeking to build resilience across all parts of the United Kingdom”,³² has established 22 “Capability Workstreams”. For each of the Capability Workstreams, aims and responsibilities are defined across different government departments.³³ There are four “Structural Workstreams”, 12 “Functional Workstreams”, and finally, six “Essential Services Workstreams” (see Fig. 3).

Structural Workstreams	Functional Workstreams		Essential Services Workstreams
Central Response	Chemical, Biological, Radiological and Nuclear Resilience	Mass Fatalities	Health Services
Regional Response	Infectious Diseases – Human	Humanitarian Assistance in Emergencies	Food and Water
Local Response	Infectious Diseases – Animal and Plant	Flooding	Transport
Resilient Telecommunications	Mass Casualties	Recovery	Energy
	Evacuation and Shelter	Community Resilience	Telecommunications and Postal Services
	Warning and Informing the Public	Site Clearance	Financial Services

Fig. 3: The 22 Capability Workstreams according to the Cabinet Office’s Capabilities Programme³⁴

³² [Capabilities Programme](#).

³³ See [The 22 Capability Workstreams](#).

³⁴ Ibid.

Since 2010, the Cabinet Office has also offered an on-line resilience-communication and information service, which can be accessed by responders all over the UK: The National Resilience Extranet (NRE), a “secure web based browser tool that enables responders to have access to key information up to and including restricted level, for multi-agency working and communication.” The NRE is available for “all Category 1 & 2 Responders, Government Departments and Agencies and other key organisations in the UK resilience community to share knowledge, plan responses to emergency situations and manage incidents as they happen.”³⁵ The NRE is a successful project: One year after its launch, the platform is already being used by 480 organizations and approximately 2’230 users.³⁶

Community Resilience is one of the 22 “Capability Workstreams” and thus explicitly part of the government’s resilience efforts. The various programs are seen as complementing the work of professional emergency responders: “Community resilience is about communities and individuals harnessing local resources and expertise to help themselves in an emergency, in a way that complements the response of the emergency services”, according to the Cabinet Office:

“The Government’s community resilience programme aims to:

- ◆ increase individual, family and community resilience against all threats and hazards;
- ◆ support and enable existing community resilience, expand and grow these successful models of community resilience in other areas;
- ◆ support effective dialogue between the community and the practitioners supporting them;
- ◆ raise awareness and understanding of risk and local emergency response capability in order to motivate and sustain self resilience;

- ◆ evaluate the success and articulate the benefits of community resilience; and
- ◆ provide a shared framework to support cross sector, regional and local activity in a way that ensures sufficient flexibility to make community resilience relevant and workable in each local area/community.”³⁷

In order to achieve greater community resilience, the government has published the “Strategic National Framework on Community Resilience”.³⁸ In March 2011, the “Community Emergency Plan Toolkit”³⁹ and “Preparing for Emergencies: A Guide For Communities”⁴⁰ have been published. The next steps, according to the National Framework, include “supporting and seeding local initiatives to build resilience by giving local communities opportunities and tools to be able to undertake resilience and preparedness activity (from spring 2011 onwards)” and “assessing the Government’s contribution to determine what more is needed, consolidating existing contribution to provide support to ongoing projects (late 2011 onwards)”.⁴¹

35 [National Resilience Extranet](#).

36 Cabinet Office (2011). [National Resilience Extranet Newsletter, vol. 2, no. 1](#).

37 [Community Resilience](#).

38 Cabinet Office (2011). [Strategic National Framework on Community Resilience](#).

39 Cabinet Office (2011). [Emergency Plan Toolkit](#).

40 Cabinet Office (2011). [Preparing For Emergencies: Guide for Communities](#).

41 Cabinet Office (2011). [Strategic National Framework on Community Resilience](#), pp. 15f.

Australia

Definition:

There is no general short definition for resilience in Australia. Across various government agencies, there is, however, a strong emphasis of resilience being a qualitative and practically-oriented concept: “Resilience is not a plan, or a checklist. The capacity of resilience is found in an organisation’s culture, attitudes and values. [...] Resilience is the capability of an organisation to minimise the impact of severe disruption events on the business, the ability to ‘bounce back’”⁴², as defined during the National Organisational Resilience Framework Workshop 2007. Similarly, the definition by Australia’s “Trusted Information Sharing Network for Critical Infrastructure Resilience”⁴³ states that “[t]here is no one blueprint for a resilient organization” because resilience is a “combination of culture and attitude, process and framework.”⁴⁴ Since organizational resilience is said to be hard to pin down, the focus is on qualitative aspects:

“[R]esilience is strongest in organisations that show all or a combination of the following traits:

- ◆ anticipates emerging threats and understands their impact on the organisation’s objectives and goals
- ◆ understands the operational and system dependencies that support and underpin the organisation’s strategic direction
- ◆ fosters and supports a partnership with critical supply chains, sectoral and community stakeholders

- ◆ possesses an ability to respond to and recover from disruptions quickly and holistically
- ◆ adapts and reacts flexibly to restore and strengthen the routine functioning and operation of the organisation
- ◆ nurtures and supports loyal staff
- ◆ articulates clearly the organisational objectives through effective leadership, and
- ◆ establishes a strong sense of purpose in response to and recovery from a disruption”.⁴⁵

Such a qualitative definition may serve as a practical guide for implementing hands-on resilience programs. The definition in Australia’s “Critical Infrastructure Resilience Strategy” stresses the flexibility of the concept and the fact that can be adapted to different contexts:

“[i]n the context of critical infrastructure, resilience refers to:

- ◆ coordinated planning across sectors and networks
- ◆ responsive, flexible and timely recovery measures, and
- ◆ the development of an organisational culture that has the ability to provide a minimum level of service during interruptions, emergencies and disasters, and return to full operations quickly.”⁴⁶

Relevance:

Like the UK, Australia embraces the concept of resilience in the areas of National Security, emergency management, and CIP. Also, community resilience programs are in place. As early as 2001, resilience was made a policy priority in emergency management.⁴⁷ Some years later, it was made a top policy priority

42 Trusted Information Sharing Network for Critical Infrastructure Resilience (TISN). *National Organisational Resilience Framework Workshop: The Outcomes, 5th – 7th December 2007, Mt. Macedon Victoria, Australia*, p. 6.

43 This network is an online information and communication service similar to the UK’s NRE, see *Trusted Information Sharing Network (TISN)*.

44 TISN (2008). *Executive Guide: Resilience*.

45 Ibid.

46 Australian Government (2010). *Critical Infrastructure Resilience Strategy*, p. 8.

47 Australian Department of Human Services (2000). *Assessing Resilience and Vulnerability in the Context of Emergencies: Guidelines*.

across government sectors: In late 2007, a wide range of professionals representing industry, government, and academia met for the National Organisational Resilience Framework Workshop. The workshop's aims were to "create a network of key leaders on organisational resilience thinking, to produce a discussion paper on organisational resilience, and to develop a set of activities that would enhance the resiliency of Australian infrastructure owners and operators."⁴⁸

The workshop had a major impact on Australian policy. Already one year later, former prime minister Kevin Rudd's "First National Security Statement to the Parliament" defined "Preserving Australia's cohesive and resilient society and the long term strengths of our economy" as one of Australia's "clear and enduring security interests".⁴⁹ Since then, the concept of resilience has been introduced all across the Australian government. "The time has come for the protection mindset to be broadened – to embrace the broader concept of resilience [...] The aim is to build a more resilient nation – one where all Australians are better able to adapt to change, where we have reduced exposure to risks, and where we are all better able to bounce back from disaster", Robert McClelland MP, Attorney-General, said on 9 December 2009.⁵⁰

Impact on government programs:

As early as 2001, guidelines outlining "principles, strategies and actions" were published, serving to assess resilience and vulnerability in the context of emergency management.⁵¹ Since 2007, a variety of

resilience strategies and programs have been developed and implemented in various areas. As seen above, the resilience definitions themselves, by their qualitative nature, strongly support practical, hands-on programs. In the area of CIP, there is the "Critical Infrastructure Resilience Strategy", as well as the TNIS information and communication service. In the area of disaster management, the Council of Australian Governments (COAG) agreed on 7 December 2009 "to adopt a whole-of-nation resilience based approach to disaster management".⁵² The resulting "National Strategy for Disaster Resilience"⁵³ was adopted by the COAG on 13 February 2011. The concept has also been introduced and implemented for all Australian emergency response services. On 6 November 2008, the Ministerial Council for Police and Emergency Management – Emergency Management (MCPPEM-EM) agreed "that the future direction for Australian emergency management should be based on achieving community and organisational resilience", leading to the implementation of the "National Disaster Resilience Framework".⁵⁴ Also, Australia's counter-terrorism efforts now embrace the concept of resilience: One of the new strategy's four "key points" is "Resilience: building a strong and resilient Australian community to resist the development of any form of violent extremism and terrorism on the home front."⁵⁵

The concept of community resilience continues to play an important part. The National Strategy for Disaster Resilience has several chapters on community resilience under headings such as "Communicating with and educating people about risks", "Partnering with those who effect change", or "Empowering indi-

48 [National Organisational Resilience Framework Workshop](#), p. 4.

49 Rudd, Kevin (2008). [First National Security Statement to the Parliament, Address by the Prime Minister of Australia, The Hon. Kevin Rudd MP, December 4 2008](#).

50 Robert McClelland MP (2010), quoted in: [Critical Infrastructure Resilience Strategy](#), p. 6.

51 Buckle, P., G. Marsh, et al. (2001). [Assessing Resilience & Vulnerability: Principles, Strategies & Actions. Guidelines prepared for Emergency Management Australia](#).

52 Australian Government (2011). [Organisational Resilience: Position Paper for Critical Infrastructure](#).

53 Council of Australian Governments (2011). [National Strategy for Disaster Resilience](#).

54 Australian Government (2010). [National Disaster Resilience Framework](#), p. 1.

55 Australian Government (2010). [Counter-Terrorism White Paper: Securing Australia – Protecting our Community](#), p. iii.

viduals and communities to exercise choice and take responsibility”.⁵⁶ The government publishes guides⁵⁷ and offers workshops⁵⁸ on how to make communities more resilient.

Canada

Definition:

Although no single official definition is available, government agencies use roughly the same definition throughout, making only slight adaptations and specifications in different contexts. In the “Federal Policy For Emergency Management” (2009), resilience is defined as “[t]he capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure.”⁵⁹ In the “Chemical, Biological, Radiological, Nuclear and Explosives Resilience Strategy”, “[r]esilience [...] refers to Canada’s capacity to adapt to CBRNE hazards before, during, or after a CBRNE event in order to reach and maintain an acceptable level of functioning.”⁶⁰ The most detailed definition is from the “Emergency Framework for Canada”:

“Resilience is the capacity of a system, community or society to adapt to disturbances resulting from hazards by persevering, recuperating or changing to reach and maintain an acceptable level of functioning. Resilient capacity is built through a process of empowering citi-

zens, responders, organizations, communities, governments, systems and society to share the responsibility to keep hazards from becoming disasters. Resilience minimizes vulnerability; dependence and susceptibility by creating or strengthening social and physical capacity in the human and built environment to cope with, adapt to, respond to, and recover and learn from disasters.”⁶¹

In mentioning a “process of empowering”, this longer definition also outlines resilience enhancing methods. Resilience is understood as an all-encompassing strategy that must be built and developed on all levels, in the community, the private sector, and the government.

Relevance:

The relevance of the concept of resilience in Canada is a rather new development: In Canada’s National Security Strategy (2004),⁶² the term is only used in the public health context. Since then, resilience has become the central focus of Canada’s policies in the areas of CIP and emergency management; the term is used across different government agencies and in the development of hands-on programs. Today, the concept is used in the areas of national security, emergency management, and CIP. It is central to all new documents considered for this focal report. Additionally, there are efforts to enhance community resilience.

Impact on government programs:

Strategies and hands-on-programs exist for all areas mentioned in the definition of the term – community, private sector, and government. The “National

56 [National Strategy for Disaster Resilience](#), pp. 9–11.

57 Australian Social Inclusion Board (2009). [Building Inclusive and Resilient Communities](#).

58 For Example: Australian Government, Attorney-General’s Department (2011). [Connect! Workshop on Community Resilience, Emergency Management and New Media, April 13–15 2011](#).

59 Public Safety Canada (2009). [Federal Policy for Emergency Management](#), p. 7.

60 Public Safety Canada (2011). [Chemical, Biological, Radiological, Nuclear and Explosives Resilience Strategy for Canada](#), p. 2.

61 Public Safety Canada (2011). [An Emergency Management Framework for Canada: Ministers responsible for Emergency Management. 2nd Edition](#), p. 8.

62 [Securing an Open Society: Canada’s National Security Policy](#) (2004).

Strategy for Critical Infrastructure”,⁶³ which “establishes a collaborative, federal-provincial-territorial and private sector approach built around partnerships, risk management and information sharing and protection”, is complemented by the “Action Plan for Critical Infrastructure”.⁶⁴ The Action Plan is “the blueprint for how the Strategy will be implemented to enhance the resiliency of Canada’s critical infrastructure.”⁶⁵ Three sets of resilience-enhancing actions are defined: “sustainable partnerships with federal, provincial and territorial governments and critical infrastructure sectors”, “improved information sharing and protection” and “a commitment to all-hazards risk management” (p. 2).

The Action Plan lays out the roles and responsibilities of the federal government, provincial/territorial governments, and critical infrastructure owners/operators in attaining “strengthened resiliency of critical infrastructure in Canada” and lays out a step-by-step plan:

“Within years one and two, partners will focus primarily on the development of sector networks and the National Cross-Sector Forum, as well as improved information sharing. Initial activities in support of risk management will also be undertaken at this time. Their completion is tied to the establishment of the sector networks and National Cross-Sector Forum. During subsequent years, effective sector networks and improved information sharing will enable further risk management activities (e.g., development of sectoral risk profiles, guidelines for risk assessments), emergency management planning and exercises.”⁶⁶

The establishment of “sector networks”, the “National Cross-Sector Forum”, and other information-shar-

ing practices will lead to the development of “sector-specific work plans” (p. 10f.) in the near future.

In emergency management, the Canadian government also installed a resilience-enhancing policy in December 2009. Its main objective is “[t]o promote an integrated and resilient whole-of-government approach to emergency management planning, which includes better prevention/mitigation of, preparedness for, response to, and recovery from emergencies.”⁶⁷ As with CIP, the emergency management policy lists detailed actions in order to achieve greater resilience, in a similar fashion as outlined in the national infrastructure protection plan (risk assessment, new emergency management plan, a focus on aspects such as preparedness, response, and recovery).

Community resilience policies are defined in the “Emergency Management Framework for Canada”. Emergency management and community resilience are said to be closely linked:

“Effective implementation of the four emergency management components [prevention and mitigation, preparedness, response, recovery] should be informed by robustness, redundancy, self-organization, and efficiency, which are key attributes of community resilience. Neither the emergency management components nor the attributes of community resilience should be seen as static end-states.” (p. 5)

By setting up working groups that advance the four “emergency management components”, the framework is said to automatically strengthen community resilience: “In the broadest sense, emergency management raises the understanding of risks and contributes to a safer, prosperous, sustainable, disaster resilient society in Canada” (p. 4). In the “National Emergency Response System”, an attempt to

63 *National Strategy for Critical Infrastructure* (2009).

64 Public Safety Canada (2009). *Action Plan for Critical Infrastructure*.

65 See <http://www.publicsafety.gc.ca/prg/em/ci/index-eng.aspx>.

66 *Action Plan for Critical Infrastructure*, p. 2.

67 Public Safety Canada (2009). *Federal Policy for Emergency Management*, p. 1.

“harmoniz[e] joint federal, provincial and territorial response to emergencies”, a similar point is made: “Emergency management aims to strengthen the resiliency of citizens, responders, organizations, communities, governments, systems and society to keep hazards from becoming disasters.”⁶⁸

Community resilience is also the “key goal” of the National Disaster Mitigation Strategy (2008): “[t]o protect lives and maintain resilient, sustainable communities by fostering disaster risk reduction as a way of life.” The strategy installs programs to further “public awareness, education, and outreach”.⁶⁹

Germany

Definition:

The analysis of Germany’s key policy texts in the areas of CIP, national security, and emergency management shows that words like resilience (“Resilienz” in German, or its equivalent “Widerstandsfähigkeit”) are almost completely absent. Consequently, there is no official definition of the term. However, it would be wrong to assume that the concept of resilience is inexistent in Germany. “Resilience” might be a term and concept mainly used in the English language. Instead of the word “resilience”, we find various strategic objectives like “schnellstmögliche Wiederherstellung” (quickest possible restoration).⁷⁰ Current German CIP and emergency management policies are largely congruent with the strategies of the countries discussed above.

68 Public Safety Canada (2011). *National Emergency Response System*, p. 3.

69 Public Safety Canada (2008). *National Disaster Mitigation Strategy*, p. 2.

70 Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (2010). *Neue Strategie zum Schutz der Bevölkerung in Deutschland*, p. 48.

Relevance:

Resilience is an important goal in German policies, particularly in CIP and emergency management policies, even though the concept is not theorized. One of the main goals of the “Neue Strategie zum Schutz der Bevölkerung in Deutschland” (new civil protection strategy) is “the quickest possible restoration of social and economic activities in all domains”.⁷¹ A risk-based approach is central to Germany’s CIP policies: “This means anticipating risks whenever possible, mitigating their potential consequences, and being as well prepared as possible for inevitable crises. Such an approach is conducive to ensuring continued existence even after a crisis has occurred. [...] The impact of a crisis and the required time to reestablish normal conditions can be reduced.”⁷²

“The federal government’s overarching goal”, according to the guide “Schutz Kritischer Infrastrukturen”, “is to mitigate the consequences of an extreme event for critical infrastructures [...]” (p. 9). Resilience is thus the main goal of CIP policy: “The goal of crisis management for critical infrastructure facilities is to cope with and overcome a crisis while at the same time sustaining functionality of critical processes, or ensure the quick restoration thereof.” (p. 23). Also, “the most important functions of crisis management are: creating the conceptual, organizational and procedural preconditions for successful coping with an extreme event [...]” (p. 24).

Impact on government programs:

Resilience is the clear goal of practical guidelines in CIP. The national CIP strategy of 2009 (KRITIS-Strategie) makes the same point. The strategy is based on

71 Ibid. Note: Quotes in this section were translated from German into English by the authors.

72 Bundesministerium des Innern (2007). *Schutz Kritischer Infrastrukturen – Risiko- und Krisenmanagement: Leitfaden für Unternehmen und Behörden*, pp. 7f.

“strong and self-conscious self-protection efforts of individuals and infrastructures affected by disturbances or failures of critical infrastructures. Such a new risk culture is suitable for making society more robust and resilient (*widerstandsfähig*) in dealing with increasing vulnerabilities.”⁷³ The term “*widerstandsfähig*” is as close as the document comes to using the actual word “resilient”. In the KRITIS-Strategie, the concept reappears under the heading “reaction”: “In case of disturbance or damage, all activities must be directed at maximum effectiveness in order to ensure the quickest possible resumption of normal operations” (p. 10). Again, the methods for attaining this goal are ongoing risk assessment, regular exercises, crisis management, and risk communication.

The German CIP “Basisschutzkonzept” provides companies with strategies and methods that help them establish emergency plans, so that “significant disruptions can be avoided, or their consequences mitigated as much as possible.”⁷⁴ CI operators have to take measures in order to lessen the impact of adverse events as much as possible:

“In order to ensure the continuity of business activities during crises, or to facilitate emergency operations until full functionality is restored, emergency plans and business continuity plans need to be conceptualized at an early state” (p. 25).

In the “Strategie für einen modernen Bevölkerungsschutz” (2009), the same points are made for emergency services and civil protection: “Crisis management denotes the establishment of conceptual, organizational, and procedural preconditions that support the quickest possible restoration of normal

conditions after an exceptional situation.”⁷⁵ For medical emergencies, the same goal is explicitly stated:

“Next to health protection and minimizing the infection rate, the main challenge lies in ensuring continued functioning of the most important structures as well as providing essential services [...] despite extreme shortages of manpower.” (p. 12)

Social resilience is also addressed in the “Strategie für einen modernen Bevölkerungsschutz”. Here, information sharing is stressed in order to build a more resilient community:

“A society that is not prepared for risks will not be able to contribute to risk minimization or the mitigation of consequences. Communities need information on coping with risks (threats, the effects of climate change, epidemics/pandemics, long lasting failure of critical infrastructures, terrorist threats, etc.) so that they are not caught by surprise by the complexity of crises, and to be able to react adequately based on their own preparation and protection measures. Only by knowing about existing risks can the population take adequate precautionary measures or consciously avoid risks [...]” (p. 27)

The “Neue Strategie zum Schutz der Bevölkerung in Deutschland” stresses the importance of society’s “Self-protection and self-help actions”: “The survival of many people and the fast restoration of safety and order depend decisively on the degree of society’s self-protection and self-help actions.” (p. 41).

Summing up, in current German policies, strategies and programs enhancing resilience are central aspects, even though the concept is not explicitly defined. For community resilience, programs try to enhance society’s “self-protection and self-help actions”.

73 Bundesministerium des Innern (2009). *Nationale Strategie zum Schutz Kritischer Infrastrukturen (KRITIS-Strategie)*, p. 9.

74 Bundesministerium des Innern (2005). *Schutz Kritischer Infrastrukturen – Basisschutzkonzept*, p. 6.

75 Bundesministerium des Innern (2009). *Strategie für einen modernen Bevölkerungsschutz*, p. 18.

Singapore

Definition:

Singapore’s concept of resilience – although there is no single official definition – differs from that of the countries discussed above. Singapore’s approach to community resilience does not only stress risk awareness, information-sharing, and the strengthening of pre-existing resilience patterns, as the UK’s or Germany’s community resilience programs aim to do. Instead, community resilience is an endeavor of high national priority, a cornerstone of the nation’s defense strategy and ideology, actively enacted from the top of government by various hands-on programs.

Singapore’s unique approach to social resilience is perhaps best described as being not only pragmatic, but also ideological. This fact was recently addressed in a speech by Wong Kan Seng, Deputy Prime Minister and Coordinating Minister for National Security in April 2011:

“These dimensions – the pragmatic, affective and ideological – form the three building blocks of the ‘Resilience DNA’ during peace time that societies need to invest in order to respond to and recover successfully from a crisis.”⁷⁶

While we have seen some “pragmatic” aspects of social resilience in other countries above (for example, preparing communities with emergency preparation guides in the UK), what Wong Kan Seng defines as the ideological (“belonging and identity”) and the affective (“bonds [of people] with their neighbors, local business owners and community organizations”) dimensions of resilience are uniquely Singaporean.

⁷⁶ Wong Kan Seng (2011). *Opening Address by Mr. Wong Kan Seng, Deputy Prime Minister and Coordinating Minister for National Security, at the 5th Asia Pacific Programme for Senior National Security Officers (APPSNO), 11 April 2011*, pp. 4f.

Both dimensions are actively pursued by the Singaporean government.

Relevance:

The concept of resilience is also used in the context of CIP policies in Singapore. In this respect, there is no difference between Singapore’s use of the concept and that of the nations discussed above. Consider, for example, the efforts of the government’s Energy Market Authority (EMA): One of the main goals of the 2005 report “Ensuring Reliability” is “building crisis resilience” of all systems.⁷⁷ Or consider the nation’s “Infocomm Security Masterplan” (2008), a “five year roadmap” for securing the information infrastructure. One of its key aims is to “build up the resilience of Singapore’s national infocomm infrastructure and services against cyber attacks.”⁷⁸

The concept of social resilience differs in definition, scope, and importance. As early as 1984, Singapore launched the national strategy of “Total Defence” (TD). Supposedly “adapted from the experience of countries like Switzerland and Sweden”,⁷⁹ the strategy is based on the “five pillars” of Military Defence, Civil Defence, Economic Defence, Social Defence, and Psychological Defence.⁸⁰ TD is also central to Singapore’s National Security Strategy of 2004:

⁷⁷ Energy Market Authority (2005). *Ensuring Reliability: EMA annual report 2004/05*, p. 22.

⁷⁸ Info-communications Development Authority of Singapore (2008). *Fact Sheet: Infocomm Security Masterplan*, pp. 1ff.

⁷⁹ Government of Singapore (2008). *Total Defence: Protecting the Singaporean Way of Life*, p. 2. The “adaptation” of total defence alludes to the European Nordic countries’ Societal Security System, which is based on the “total defense” system of the Cold War. See Bonin, S., Doktor, C. and Habegger, Beat (2009). *Focal Report 2 Risk Analysis: Integrated Risk Management and Societal Security. Zurich: Center for Security Studies (CSS)*, p. 4. However, there are crucial differences between the two uses of TD that are not within the scope of this report.

⁸⁰ The pillar of “Psychological Defence” is defined as “Being a Singaporean and proud of it”, closely related to Social Defence, which is “about people living and working together in harmony and spending time on the interests of the nation and community”. See *Total Defence: What Is Total Defence?*

“Total Defence is about the different things we can do every day in every sector of our society to strengthen our resilience as a nation. When we take National Service seriously, participate in civil emergency exercises, upgrade ourselves and learn new skills, build strong bonds with different races and religions, and feel the pride of being Singaporean, we contribute to Total Defence.”⁸¹

Evidently, “the nation’s resilience” is closely associated with the concept of TD. Consequently, the countries’ resilience strategies have to be seen as parts of the concept of TD.

Impact on government programs:

Social resilience programs are “deliberate” government efforts, as Charles Ng, an Executive of Singapore’s National Security Coordination Secretariat (NSCS) pointed out in his lecture *Historic Background on Policy in Singapore and Its Relevance to Resilience* at the International Symposium on Societal Resilience 2010 in Fairfax, Virginia. For the government, Ng said, “social cohesion is crucial” – the aim is building “a strong nation of shared experience”, “embracing multiculturalism” and advocating “racial harmony”. One example is Singapore’s “deliberate housing policy”: There is a “racial quota” ensuring that all housing complexes are ethnically integrated.

One of the many community resilience efforts is the “Community Engagement Programme”⁸² (CEP) that aims to “develop response plans that communities could use to reduce racial, religious or communal tensions”. The CEP, according to its homepage, is “[a] network of people to help prevent racial and religious conflict” that “seeks to strengthen the understanding and ties between people of different races and religions, and build up our society’s skills

and knowledge in coping with emergencies.” Five societal “clusters” are engaged in the program: Religious/ethnic organizations, educational institutions, media, businesses, and unions as well as grassroots organizations. The CEP’s programs and initiatives are too numerous to be considered in detail here; however, the document “National Community Engagement Programme Dialogue”⁸³ provides an overview.

While the CEP is targeted mainly at adults, there are also a large number of programs especially for children. In 1997, the Ministry of Education launched the “National Education Programme”,⁸⁴ which “aims to develop national cohesion, cultivate the instinct for survival as a nation and instill in our students, confidence in our nation’s future. It also emphasizes on cultivating a sense of belonging and emotional rootedness to Singapore.” The program is aimed at the country’s high schools, and it has clear ties to the five pillars of TD and is one of the cornerstones of building the nation’s resilience.

The same kind of social resilience is also an integral part of Singapore’s counter-terrorism security strategies. The closing chapter of Singapore’s National Security Strategy is entitled “Robust Security, Resilient Nation” and states that the government “has focused on shoring up psychological resilience. It is vital that we remain undaunted as a people in this battle against terrorism, as strong in mind as the country is steadfast in purpose.”⁸⁵ Again, this strategy for enhancing social, or, as it is called here, “psychological” resilience, is also specifically targeted at children. For example, in the National Security Coordination Secretariat’s 45-page comic book “Fight terrorism, don’t joke”, the four fictional characters Meng Teck, Benson, Kumar, and Salim are “a group of Secondary Two students from a local secondary school. As each of

81 National Security Coordination Centre (2004). *The Fight Against Terror: Singapore’s National Security Strategy*, p. 60.

82 *Community Engagement Programme*.

83 *National Community Engagement Programme Dialogue 2011*.

84 *National Education Programme*.

85 *The Fight Against Terror: Singapore’s National Security Strategy*, p. 66.

them represents one of the four major races in Singapore, they are also known as ‘Mini Singapore’ among their classmates.”⁸⁶ In the story, the four friends, previously “oblivious to the very real threat of terrorism”, become a “team of alert and well-prepared Singaporeans ever ready to protect our nation from the terrorists”, for instance by learning about the terrorist attacks of 11 September 2001 in the US, the importance of “being watchful”, and “stay[ing] united as one”.⁸⁷

All the examples of social resilience above demonstrate that social resilience in Singapore is indeed different from supporting society’s “Selbstschutz- und Selbsthilfetätigkeit” (in Germany) or general governmental assistance and support of “communities and individuals harnessing local resources and expertise to help themselves in an emergency” (in the UK). It is an all-encompassing national framework that reaches beyond society’s emergency preparedness and response capabilities (although this aspect is also addressed, for example in the Civil Defence Force’s “Emergency Handbook”⁸⁸), beyond practical skills or a desired mindset of risk thinking. Rather, resilience is part of a desired national ideology (“racial” and cultural harmony as well as patriotism) that is deliberately furthered by the state in various programs, starting with school children.

Another distinct characteristic of the Singaporean social resilience programs is the fact that all the efforts are developed from the top of government – they are top-down approaches to building social resilience. In this, again, the Singaporean model differs sharply from the approaches of Germany or the UK: rather than trying to strengthen society’s already established “emergency preparedness and response capabilities” or its “Selbstschutz- und Selbsthilfetätigkeit” by giving organizational, informational, and financial

support, the Singaporean government tries to shape social resilience from the top. Some of the possible problems of this approach have been addressed by Dr. Norman Vasu, assistant professor at Singapore’s Rajaratnam School of International Studies at Nanyang Technological University. In his speech at the International Symposium on Societal Resilience 2010 in Fairfax, Virginia, he said that “because [the efforts are] derived solely from government stewardship, this may undermine the future development of social resilience in Singapore.” The fact that “social resilience is being steered from the top down rather than from the larger idea-base in society” could therefore be “a problem”. Also, he added the caveat that “the government’s very presence in these measures [...] may turn off those wary of big brother and also, these programs will only attract those already converted.” As an example, he mentioned students being fed up with all the programs and leaflets from the National Education Programme, which they regard as government propaganda.⁸⁹

Israel

Definition:

Israel’s handling of the concept of resilience differs again from all countries discussed above. While we have not found an official definition of the term, it is clear that although it also plays a role in CIP and disaster management, the main application of “resilience” is in the fields of counter-terrorism and social resilience. Although there is no specific official definition of the term, it is clear from the government’s various programs that coping with and rebounding from disasters and terrorist attacks, as well as ensur-

86 National Security Coordination Secretariat (2010). *Fight terrorism, don’t joke*, p. 3.

87 Ibid, p. 3, 35.

88 Civil Defence Force (2010). *Civil Defence Emergency Handbook*.

89 Vasu, Norman (2010). *Societal Resilience Regarding Singapore*, presentation at the International Symposium on Societal Resilience 2010 in Fairfax, Virginia.

ing continued functioning of critical services and societal life, are the goals of Israel's resilience efforts.

Relevance:

In Israel, many aspects of homeland security, CIP, and emergency management are organized under the lead of the Home Front Command – one of the four regional commands of the Israel Defense Forces (IDF). The Home Front Command was established in 1992 after, and directly influenced by, the Gulf War of 1990. “The Gulf War was a different type of war, a war in which the rear had to protect itself and in fact became the front,”⁹⁰ is the official Home Front Command's explanation for the establishment of the new command. The rear became the front, or in other words: The Gulf War was perceived as posing an even greater threat to civilian centers than the numerous crises Israel had lived through before.

Many aspects of Israel's emergency policies differ from those from other countries. Although there are elements of an “all-hazards approach” (e.g., the Ministry of National Infrastructures is responsible for handling earthquakes,⁹¹ while hazardous materials are the responsibility of the Ministry of the Environment), most specific policies explicitly concern terrorist attacks. The Home Front Command lists the following threats (and ways to deal with them) on its homepage: “Long Range Rockets; Mortars; Qassam Rockets; Chemical Weapons; Biological Warfare; Terrorism; Fire; Floods; Radioactive Leaks; Industry and Hazardous Materials.”⁹² Clearly, terrorist threats take precedence over natural disasters.

However, even concerning terrorist attacks, there is still no single unified security strategy in Israel – a fact that is deplored by security policy experts: “Israel

has never defined agreed-upon national objectives in writing since the time of David Ben-Gurion, and there is no coherent, systematic, and significant discussion of security doctrine and policy.”⁹³ While experts agree that “[...] the unique Israeli circumstance, in which war and large scale terrorism are clearly the most blatant risk to the civilian front, justifies a specific response to this severe threat [...]”,⁹⁴ the nature of this specific response – for instance, the nature of a proposed new unifying “home front law” – is still a matter of debate.

Impact on government programs:

Israel's social resilience programs are highly regarded internationally, despite the fact that there is no single unifying law, policy or “civil resilience network”.⁹⁵ One of the Home Front Command's duties and responsibilities for enhancing social resilience is “to train all parts of the public in matters of civil defense, both in emergencies and in normal times.”⁹⁶ The public training for emergencies starts in school; there is a whole range of disaster training activity for companies, organizations, people with special needs, and hospital personnel. The importance of training/education is central to the Israeli way of dealing with terrorism. Already in 1995, security experts pointed out the importance of “educating the public to be familiar with the terrorists' strategy, which will frustrate the achievement of their goal – the instilling of fear and lack of personal security.”⁹⁷

⁹⁰ *The Home Front Through Time.*

⁹¹ *Steering Committee for Preparation for Earthquakes.*

⁹² *The Home Front Command: About The Threats.*

⁹³ Shabtai, Shay (2010). *Israel's National Security Concept: New Basic Terms in the Military Security Sphere.* In: Strategic Assessment, 13/2, August 2010, p. 7.

⁹⁴ Elran, Meir (2011). *A Home Front Law For Israel.* In: Strategic Assessment, 13/4, January 2011, p. 55.

⁹⁵ The Reut Institute (2009). *Civil Resilience Network: Conceptual Framework for Israel's Local & National Resilience,* p. 14.

⁹⁶ The Home Front Command: *Training the Public.*

⁹⁷ Ganor, Boaz (1995). *A New Strategy Against The New Terror.* In: Policy View, 10/1995.

In a presentation on resilience in Israel, Lieutenant Colonel Rami Peltz, Head of the Home Front Command’s Behavioral Sciences Branch, explained the “five pillars of civil defense” that lead to greater resilience (see Fig. 4):

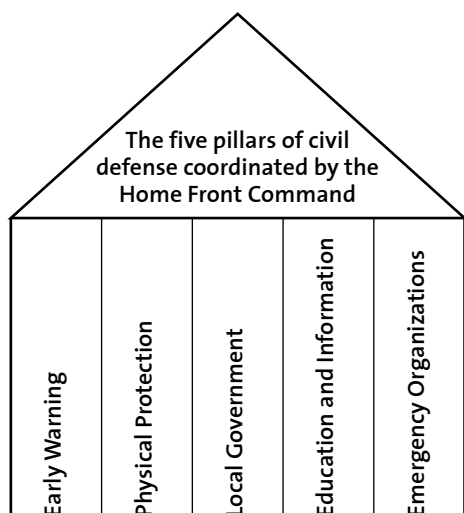


Fig. 4: The five pillars of civil defense in Israel.

According to Peltz, “Early Warning” is organized according to the division of Israel into 27 separate “Alarm Zones”. “Physical Protection” is provided, among other things, by the distribution of gas masks and the building of bomb-shelters for every citizen. During emergencies, “Local Government” fulfils important coordination functions. Furthermore, the public (everyone from schools to organizations) is prepared by “Education and Information”. Finally, “Emergency Organizations” are regularly trained.⁹⁸ All these efforts are coordinated by the Home Front Command. Peltz pointed out the importance of regular exercises, since the goal is “that people keep their routine”, even “under rocket attack”.

Some specific social resilience programs even continue in a state of emergency. During a crisis, the Home Front Command conducts regular “public evaluations” in an attempt to measure society’s “sense of coping”. Questions like “Am I coping successfully with the situation?” or „How would you grade your capability to deal with the current situation?“ are asked of the population every second day, according to Peltz. These surveys form “the basis for the protection plan and the intervention policy”: If they show that the public has difficulties in coping, new intervention plans are put in place.

To sum up, Israel has – although an overarching national security strategy may still be lacking – many specific programs in the area of social resilience. Social resilience programs, under military lead, are central to coping with the terrorist threat. Regular training (schools, private households and businesses), education and surveys for measuring and enhancing the population’s resilience to a wide range of disasters are central to Israel’s way of preparing and coping with emergency situations.

⁹⁸ Peltz, Rami (2010). *Goals of Israel's Defense Forces*. Paper presented at the International Symposium on Societal Resilience, Fairfax VA, 30 November – 2 December 2010.

2.2 Comparison and analysis

The concept of resilience is important for all countries analyzed in this report. However, there are some significant differences in the definitions of resilience used by various countries, and consequently in the nature of particular government programs aiming to enhance resilience.

First, the similarities: For the US, the UK, Canada, Australia, and Germany, the definitions of the term are largely congruent. In all those countries, resilience is understood as the ability of systems, infrastructures, government entities, businesses, and society to adapt to adverse events, to minimize the impacts of such events (keeping the system running), and also to anticipate future adverse events and be able to prevent them. In all of these countries, new policies for strengthening resilience have been put in place within the last decade. In these five countries, resilience-enhancing policies in the areas of CIP and emergency management are in place. There are only slight differences in the handling of community resilience in the above five countries. The concept of community/social resilience is, in all of these countries, closely linked to emergency and disaster management. The focus is on better information and preparation for disasters and hazards and the (financial and organizational) support of existing community resilience networks. Some countries (like Australia) also link their anti-terrorism efforts to the notion of resilient communities.

Two countries analyzed in this focal report differ greatly concerning their resilience concept and resilience strategies. In Singapore, where the focus is almost exclusively on social resilience, the concept is closely linked to the national paradigm of “Total Defence”, dating back to 1984. It is not merely linked to disaster and emergency preparedness: Resilience, in Singapore, is a desired national ideology (“racial” and cultural harmony, patriotism), enforced by the gov-

ernment with various programs, starting with school children. In Israel, as in Singapore, social resilience is the primary concept. Social resilience is almost exclusively linked to Israel’s counter-terrorism efforts; unlike in the other countries, it is under military, not under civilian command. The government provides extensive programs educating the community on the threats, providing training and protection material, and it even conducts resilience surveys during actual times of crisis.

3. ASSESSING AND MEASURING RESILIENCE

It was demonstrated in the previous chapter that the importance of resilience as a guiding principle in national security policy has grown considerably in the past few years. Resilience is now featured prominently in a number of key national security policy documents.

The growing commitment by policy-makers to translate the resilience concept into hands-on programmatic efforts is accompanied by an ambition to be able to assess and evaluate the resilience of communities and infrastructures. To quote the Senior Director for Preparedness Policy at the White House’s Resilience Directorate: “*We need to know where we are now, and how we will know when we have improved.*”⁹⁹ He pointed out that a “*system of metrics and measurements*” is indispensable both to identifying the need for action and to evaluating the steps taken to enhance resilience. The desire to be able to assess and, if possible, quantify resilience was a recurrent theme at the 2010 International Symposium on Societal Resilience in Washington, D.C. One of the most ambitious proposals put forward at the symposium and subsequent strategic planning meeting of the International Resilience Research Network (IRRN) was the development of an international comparative index of societal resilience.

To date, there is no commonly accepted set of indicators to measure the resilience either of communities or of critical infrastructures. There are, however, a number of “pilot projects” to develop resilience indices both in academia and in government. The following section presents and analyzes a selection of them. Based on this discussion, section 3.2 then identifies promises and pitfalls of measuring resilience

⁹⁹ Kamoie, B. (2010). *Speech* at the International Symposium on Societal Resilience, Fairfax VA, November 30–December 2, 2010.

and discusses the prospects for further progress in this area.

3.1 Selected projects for measuring resilience

This section presents a selection of academic and government projects that aim to assess and measure the resilience of communities and – in one case – of critical infrastructures. There are efforts to measure the resilience of infrastructures more generally in the fields of resilience engineering and enterprise resilience.¹⁰⁰ These are not discussed here, and the focal report focuses exclusively on *critical* infrastructures from a national security perspective. Moreover, most of the projects presented here are from the US; it seems that the US is indeed leading in the endeavor to measure resilience, but as always, selection bias cannot be excluded.

Critical Infrastructure Resilience Index, US¹⁰¹

The Argonne National Laboratory (in partnership with the DHS) has created a Resilience Index (RI) for critical infrastructure facilities. The RI, together with a Protective Measures Index (the inverse of which is the Vulnerability Index) and a Criticality Index, is used to calculate an overall Risk Index (see Fig. 5).

¹⁰⁰ See, for example: *Resilience Engineering Network*; Erol, O. et al. (2010). *Perspectives on measuring enterprise resilience*. Paper presented at the 4. Annual IEEE Systems Conference, 5–8 April 2010.

¹⁰¹ Petit, F. et al. (2011). *An index to analyze resilience of critical infrastructure*. In: *The CIP Report 9/8, 2011*. Arlington, VA: Center for Infrastructure Protection and Homeland Security; Fisher, R.E. and M. Norman (2010). *Developing measurement indices to enhance protection and resilience of critical infrastructure and key resources*. *Journal of Business Continuity & Emergency Planning* 4(3), pp. 191–206.

All three indices are developed within the framework of the DHS’s Enhanced Critical Infrastructure Protection (ECIP) program. The ultimate goal of the ECIP program is to provide useful information to owners/operators of critical infrastructures for their risk management decisions. While the other two indices measure physical security, security management, security force, information-sharing, protective measures, and dependencies (Vulnerability Index), and economic, human, governance, and mass evacuation impacts (Criticality Index), the RI measures the ability of a system to withstand the impact of a specific event and to return to normal after degradation.¹⁰²

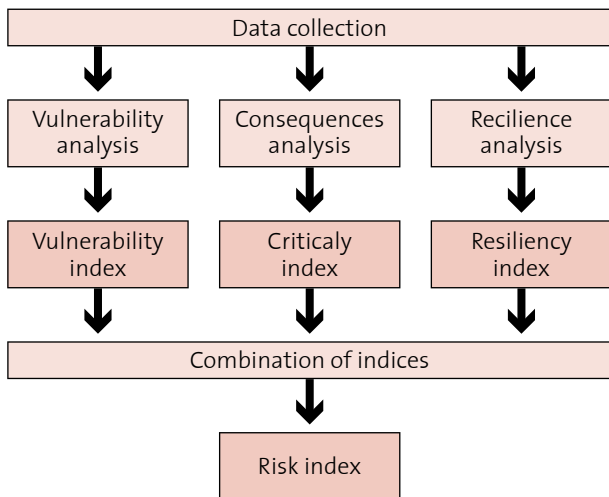


Fig. 5: Resilience Index as part of an overall risk index for critical infrastructures (Source: Fisher and Norman, p. 196).

Data for the RI is collected in a survey tool during regular ECIP facility visits. The tool includes more than 1’500 data points and can be completed by an analyst in one visit of roughly four to eight hours. The survey covers the existing protective and resilience measures of a facility by gathering data at the most vulnerable point for each measure.

¹⁰² Following the resilience definition of the DHS National Infrastructure Advisory Council (NIAC) as the “ability to reduce the magnitude and/or duration of disruptive events”. NIAC (2009). *Critical infrastructure resilience: Final report and recommendations*. Arlington, VA.

Resilience is measured on three levels in order of increasing specificity (see Fig. 6).

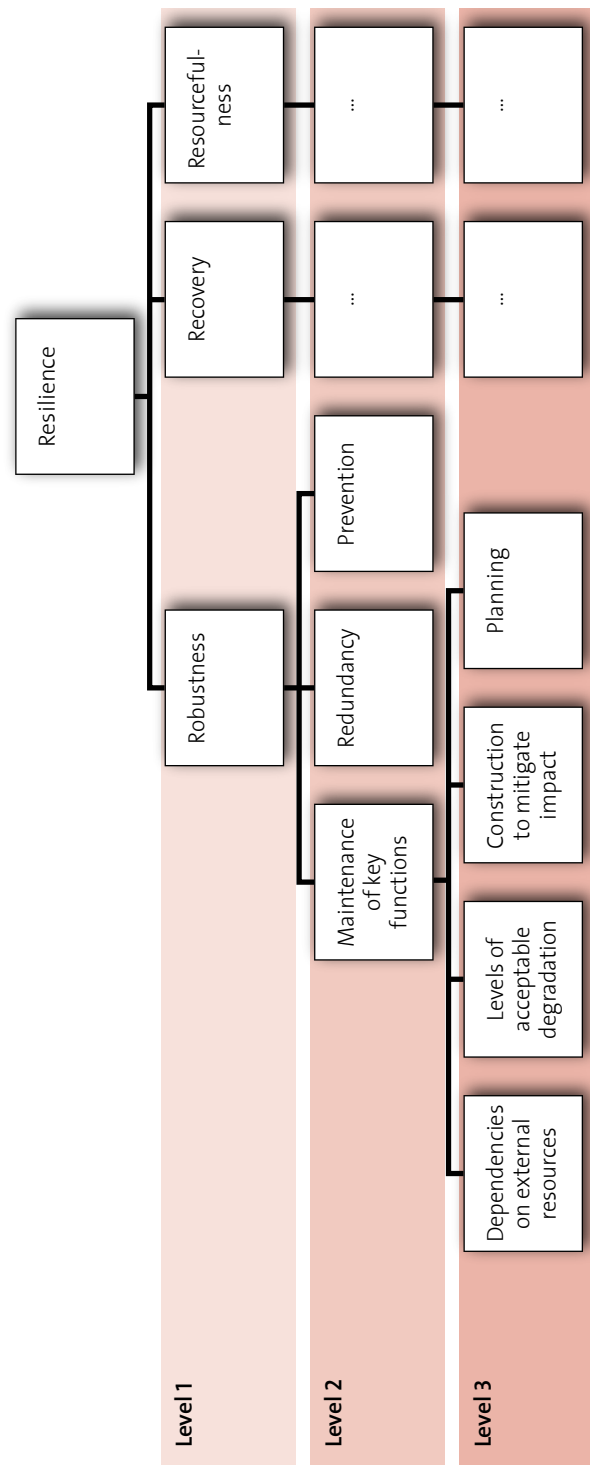


Fig. 6: Three levels of resilience in order of increasing specificity.

Level 1 covers the three main resilience components defined by the NIAC: robustness, recovery, and resourcefulness.¹⁰³ Each of these level 1 categories is divided into subgroups at level 2 that account for different related elements. For example, “robustness” is comprised of the level 2 components “maintenance of key functions”, “redundancy”, and “prevention”, which are then again divided into level 3 components.

The RI is calculated by aggregating the sub-indices. Components on lower levels have been weighted by an expert panel to represent their relative importance to the successive levels.

The RI score ranges from 0 (low resilience) to 100 (high resilience). It is a relative measure that permits comparison between facilities of a similar type. Additionally, the owners/operators of a facility are provided with a “dashboard” display of their resilience characteristics that allows them to change characteristics at each level and immediately see the potential changes to the overall values of the RI if certain additional measures were implemented.

Resilience Policy Index, US¹⁰⁴

A group of researchers at Florida Atlantic University is currently working on a societal resilience index as part of a three-year National Science Foundation grant to study hurricane-related population displacement, housing, and land development policy issues in eight coastal US states. The aim is to operationalize some of the multiple dimensions of resilience and develop a so-called Resilience Policy Index (RPI) as a

¹⁰³ Robustness: the capability of a system to resist a specific event; recovery: the capability of a system to recover after crisis; and resourcefulness: both the current resources (e.g., training or planning) developed to support the facility’s robustness and new resources to support the recovery of the system (Fisher and Norman, 2010, p. 199).

¹⁰⁴ Sapat, Alka (2010). *Multiple Dimensions of Societal Resilience: Developing a Resilience Index*. Paper presented at the International Symposium on Societal Resilience, Fairfax VA, 30 November–2 December 2010.

tool for policy-makers to strengthen resilience and to stop practices that put people at risk. The unit of analysis of the study is the county. Data on lower levels of analysis (census tracts, block groups) is available, but the county level was chosen because counties are political or administrative units and have planning and policy authority. The RPI is made up of the “community and economic resilience score” and the “emergency capacity score”. Indicators for community resilience include, for example, social capital and community groups, while economic indicators such as foreclosures and housing vacancies were used to gauge economic resilience. Emergency capacity indicators include the number of hospitals, medical services, and physicians.

The choice of indicators reflects the strong focus on resilience with respect to displacement or potential displacement as a result of natural disasters. The quantitative index is intended as a starting point and should (given that additional funding can be secured) be complemented with qualitative data, such as narratives, to tell the full story of resilience. One important issue that remains unclear concerns the relationships between resilience and vulnerability and also between resilience and adaptation and mitigation measures.

Territorial Resilience Index, France¹⁰⁵

In France, two researchers are currently employed in a pilot project to develop a territorial resilience index for the administrative region of Brittany. The project is supported by the French Ministry of Ecology and Sustainable Development. The aim of the pilot project is to assess the validity of the resilience concept used and the indicators selected to assess societal resilience. Brittany was chosen as a study object because it faces major natural and industrial hazards.

¹⁰⁵ Sommade, Christian (2010). *France’s Strategy of Territorial Resilience*. Paper presented at the International Symposium on Societal Resilience, Fairfax VA, 30 November–2 December 2010.

The index is qualitative and takes into account the impact of a disaster on people, the economy, the environment, and the region's cultural heritage. To develop the index, existing processes, policies and programs in the area of prevention, emergency planning, preparedness, education, insurance, and communication were studied. Indicators were chosen to reflect eight main components of societal resilience (contributing to or reducing societal resilience): gravity, preparedness, density, trust, vulnerability, vigilance, frequency, and consciousness. Currently, no description or definition of those components or a list of indicators chosen are publicly available.

Depending on the results of the pilot project, the resilience index will be extended to two more regions in 2011. The inclusion of additional risks and threats (beyond natural and industrial hazards) is also planned. The French High Committee for Civil Defense hopes to be able to nationalize the project a couple of years from now to replace a costly system of reparation after catastrophes (insurances play a major role in France) with an approach focused more on prevention, preparedness, and societal resilience.

Evaluation of community resilience during emergency, Israel¹⁰⁶

During and after enemy/terrorist attacks on Israeli communities, the Behavioral Sciences Branch of the Israeli Home Front Command (armed forces) engages in a public evaluation of resilience in the affected communities. The Home Front Command conducts surveys in the communities under attack every other day and asks a number of questions to assess self-efficacy, coping ability, knowledge, behavior, and more. An example question is: "How would you grade your ability to deal with the current security situation?" The repetition of the surveys every other day allows to

monitor change in community resilience over time. The surveys are used to assess the assistance needs of the population and local authorities in extreme situations, and as a basis for decisionmaking in the Home Front Command with regard to the most appropriate intervention plan and protection policies.

Coastal Community Resilience Index, US¹⁰⁷

The Coastal Resilience Index developed by the US National Oceanic and Atmospheric Administration (NOAA) is a self-assessment tool for communities to examine how prepared they are for storms and to predict whether they are able to reach and maintain an acceptable level of functioning and structure after a disaster. The purpose is for communities to identify weaknesses prior to a potential hazard and guide discussion within the community. The index is not intended to compare communities with one another.

A pilot project was conducted using the index in six communities along the Gulf coast. Results from the project were used to improve the index and generate discussion among community leaders. Although it was developed for the Gulf coast region, the index can be applied to coastal communities across the US. The assessment takes into account the location of critical infrastructures (e.g., sewage, electricity) and facilities (e.g., town halls, police stations), transportation (e.g., evacuation routes), existing community plans and agreements (e.g., mitigation plans, certified planners), mitigation measures (e.g., building codes, education), business plans, and social systems (cultural, faith-based, business, and civil networks). The results translate into a score of low, medium, or high resilience. The self-assessment can be completed by local planners, engineers, floodplain managers, or administrators using existing sources of information from their community.

106 Peltz, Rami (2010). *Goals of Israel's Defense Forces*. Paper presented at the International Symposium on Societal Resilience, Fairfax VA, 30 November 30 - 2 December 2010.

107 Emmer, Rod et al. *Coastal Resiliency Index: A community self-assessment – A guide to examining how prepared your community is for a disaster*. Washington, D.C.: NOAA.

Community Disaster Resilience Index (DRi), US¹⁰⁸

The Center for Hazards Research and Policy Development at the University of Louisville has been working on a Community Disaster Resilience Index (DRi). The project is funded by the National Science Foundation. The first step in this project is the development of a Disaster Preparedness Index (DPi). The DPi, once applied, allows the development of the DRi. The DRi will be a composite of the presumed relationship between preparedness and vulnerability:

$$\text{Disaster Resilience Index (DRi)} = \frac{\text{Preparedness Index (DPi)}}{\text{Vulnerability (V)}}$$

Where DRi > 1, the community is more resilient

Where DRi < 1, the community is less resilient

The DRi can be considered to be a function of a community's preparedness in a ratio to its relative vulnerability (exposure to a unique set of hazards in that community): The higher the preparedness score, the higher the resilience level. In other words, the higher the cumulative set of hazards and exposure (vulnerability) for any given level of preparedness, the lower the resilience level.

To date, the indicator list is not weighted. The weighting of the components is considered to be a subjective process, and should be adjusted based on expert panel review or iterative on-ground application and review. Indicators for some of the proposed components of the index (hazard, community assets, social capital, infrastructure/system quality, planning, social services, population demographics) will be drawn from indicators used in other hazard-related models.

¹⁰⁸ Simpson, David M. (2006). *Indicator issues and proposed framework for a Disaster Preparedness Index (DPi)*. Draft report to the Fritz Institute Disaster Preparedness Assessment Project. Louisville: Center for Hazards Research and Policy Development.

Baseline Resilience Index (BRIC), Southeastern US¹⁰⁹

A group of researchers funded by the Community and Regional Resilience Institute (CARRI) through a grant from the Oak Ridge National Laboratory have proposed a methodology and a set of indicators for measuring baseline characteristics of communities that foster resilience. Baseline conditions are the existing conditions in a community before the implementation of any programs, policies, and interventions specifically designed to improve disaster resilience.

Resilience is understood to be a multifaceted concept including social, economic, institutional, infrastructural, ecological, and community elements, which is reflected in the subcomponents used for the creation of the index: Variables were grouped according to social resilience, economic resilience, institutional resilience, infrastructure resilience, and community capital. Ecological resilience was excluded due to data inconsistency and relevancy when developing proxies for ecological systems resilience for large and diverse study areas. Since it is often difficult to measure resilience in absolute terms, a comparative approach was used.

- ◆ The first subcomponent, social resilience, captures the differential social capacity within and between communities.
- ◆ Economic resilience measures the economic vitality of communities including housing capital, equitable incomes, employment, business size, and access to physicians.
- ◆ Institutional resilience contains characteristics related to mitigation, planning, and prior disaster experience.
- ◆ Infrastructural resilience is an appraisal of community response and recovery capacity (e.g., shel-

¹⁰⁹ Cutter, Susan L. et al. (2010). *Disaster resilience indicators for benchmarking baseline conditions*. *Journal of Homeland Security and Emergency Management* 7(1).

tering, vacant rental housing units, and health-care facilities).

- ♦ Community capital captures the relationships that exist between individuals and their larger neighborhoods and communities.

The methodology was tested in the southeastern states of Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee. The results (see Fig. 7) demonstrate that spatial variations in disaster resilience exist and are especially evident in the rural/urban divide. However, the reason for this, e.g., the individual drivers of the disaster resilience or lack thereof – social, economic, institutional, infrastructure, and community capacities – vary widely.

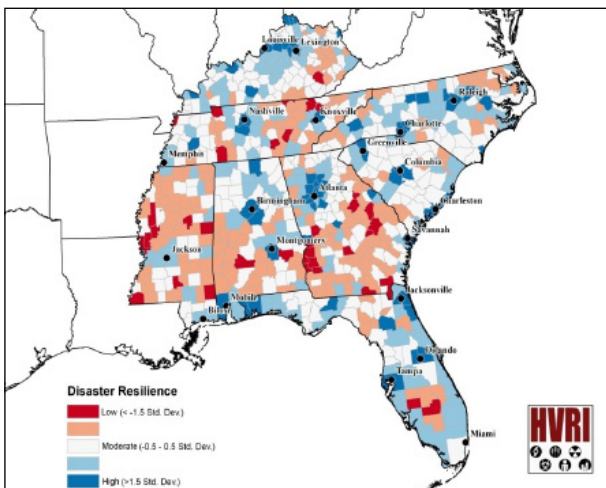


Fig. 7: Spatial distribution of disaster resilience in the Southeastern United States (Cutter et al., 2010, p. 11).

3.2 Measuring resilience: Promises and pitfalls

The resilience indices presented above differ widely with regard to several aspects of the concept and its measurement. They differ with regard to

- ♦ the **subject** of resilience: critical infrastructure resilience versus community resilience;
- ♦ the scope of potential **hazards**: hazard-specific, e.g., storms, terrorist attacks, versus multi-hazard;
- ♦ the **type of data**: quantitative versus qualitative;
- ♦ **data collection**: use of secondary data versus collection of primary data via surveys;
- ♦ the **method**: self-assessment versus third-party assessment;
- ♦ the **level of analysis**: company/facility, county, local community; and
- ♦ the **purpose** of the assessment: comparison of cases versus detailed knowledge about one case, tool for policy-makers on higher administrative levels versus tool for the respective community or infrastructure owner.

The most remarkable difference, however, concerns the operationalization of resilience, e.g., the indicators used to measure the complex, multi-faceted concept of resilience. These differences make it almost impossible to compare the above indices. This is not problematic per se if the purpose of the assessment is merely an analysis of the strengths and weaknesses of an individual community – or company – to identify the need for action and scope for improvement (as in the NOAA self-assessment). If a comparison of units is intended, however, whether in order to allocate scarce resources or to prioritize the need for action, the lack of a commonly accepted set of indicators to measure resilience is problematic.

The following section discusses some promises and pitfalls of measuring resilience, in particular if the measurements are intended to guide policy at the

national level of administration, where policy-makers of several countries have expressed their wish for “metrics and measurements” of resilience.

Promises

In a nutshell, two of the core rationales for assessing and measuring resilience are the desire to identify weaknesses and hence the need for action, and the ability to evaluate the success of any measures taken to improve resilience. The statement of the Resilience Directorate’s Senior Director for Preparedness Policy in the introduction to this chapter was to the point in this regard: *We need to know where we are now* (need for action) and *how we will know when we have improved* (evaluation). Assessments need not be quantitative, but the common assumption is that policy-makers prefer quantitative measurements – “hard facts” – over qualitative assessments.¹¹⁰ Numbers simplify reality to a greater extent than text based on open survey questions, for example. Probably more importantly, they convey the image of objectivity because they come with a “stamp of truth”.¹¹¹ The quantification of complex concepts such as resilience in the form of indicators or indices simplifies them to such an extent that they become understandable for non-expert policy-makers, which makes these indices valuable both for communicative and comparative purposes.¹¹² Composite indices in particular are

useful for describing complex and multifaceted concepts, because they summarize a lot of information along several dimensions of the concept in one number. Measuring and comparing resilience can serve the communities or companies that were assessed directly by giving them a clearer understanding of their strengths and weaknesses. Additionally, showing them where they stand in comparison with other communities and companies can encourage them to improve their resilience efforts. For policy-makers on higher levels of analysis, comparison can be useful for allocating scarce resources to the units that need them most and to justify actions taken.¹¹³

Pitfalls

Some of the difficulties encountered in assessing and measuring resilience stem directly from the conceptual quagmire described in the first part of this focal report. Other difficulties are inherent in the creation of all indices intended to capture multi-faceted social realities, but are magnified by the nature and complexity of the resilience concept. The following section discusses these difficulties.

Conceptualization of resilience:

As was demonstrated in Chapter 2, resilience is an (increasingly) important concept in national security policy. Within national security, it features most prominently in the area of CIP (resilience of infrastructures) and disaster management (community resilience). To date, these two resilience approaches have developed quite independently of each other, with some countries putting a stronger focus on community resilience (e.g., Australia, Israel) while

110 Gaither, G.H. (1997). *Performance indicator systems as instruments for accountability and assessment*. Assessment Update 9(1); Nutley, S. et al. (2007). *Using evidence: How can research inform public services*. Bristol: The Policy Press; Sutcliffe, S. and J. Court (2005). *Evidence-based policymaking: What is it? How does it work? What relevance for developing countries?* London: ODI.

111 Mies, M. (1991). Women’s research or feminist research? The debate surrounding feminist science and methodology. In: Fonow, M.M. and J.A. Cook, *Beyond methodology: Feminist scholarship as lived research*. Bloomington: Indiana University Press. Feminist scholars generally question the “pseudo-objectivity” of quantitative measurement under the guise of “value-free science”, e.g., Tickner, J.A. (2005). What is your research program? Some feminist answers to International Relations methodological questions. *International Studies Quarterly* 49(1), pp. 1–22.

112 Mustafa, D. et al. (2011). *Pinning down vulnerability: From nar-*

ratives to numbers. *Disasters* 35(1), pp. 62–86. Indicators can be seen as numbers (or values on a scale of measurement, such as low, medium, high) that aim to simplify complex observations about the “real world”. Indices are usually comprised of a set of indicators; through some mathematical combinations (e.g., weighting) of these indicators, a single index number/score is attained (see also Simpson, 2006).

113 Simpson, 2006.

others focus mainly on infrastructure resilience (e.g., the US). Additionally, it is likely that the resilience concepts used in these two fields have their roots in two separate scientific disciplines: Engineering science in the case of infrastructure resilience, and ecological systems approaches in the case of community resilience.

The distinction between critical infrastructure resilience and community resilience both in policy and academia raises an important question: Are the two systems – communities and critical infrastructures – sufficiently independent to measure their resilience separately? After all, the resilience of communities depends on their critical infrastructures being restored quickly after a disaster. The majority of these infrastructures, in turn, are owned by organizations in the private sector, who “are made up of the same people critically affected by the level of, or absence of, community resilience”. This point is made most forcefully by proponents of organizational (or enterprise) resilience.¹¹⁴ There is also a link to personal resilience. Personal resilience is linked to community, organizational, and infrastructure resilience, because during an emergency, both enterprises and emergency services depend on the availability of their employees, who might at the same time be personally affected by the disaster. It was reported, for example, that during Hurricane Katrina, officers left their duty assignments to check on and evacuate their families.¹¹⁵ To make matters more complicated, the sub-systems mentioned so far (communities, organizations, critical infrastructures) rely to a varying degree on a healthy environment, or in other words, on the resilience of ecosystems.¹¹⁶

114 Parker, R. (2011). *Mitigating disruptions through organisational resilience*. In: *The CIP Report 9/8, 2011*. Arlington, VA: Center for Infrastructure Protection and Homeland Security.

115 Clark, I. (2011). *Personal resilience is at the core of effective continuity of operations plans*. In: *The CIP Report 9/10, 2011*. Arlington, VA: Center for Infrastructure Protection and Homeland Security.

116 Adger, W.N. (2000). *Social and ecological resilience: Are they related?* *Progress in Human Geography* 24(3), pp. 347–364. The

It is thus more realistic to acknowledge that a resilient society is made up of resilient sub-systems (ecosystem, critical infrastructures, organizations, and communities/families/individuals). The relevance of each sub-system to the resilience of society as a whole differs from place to place. While the resilience of critical infrastructures is probably most important in densely populated urban areas, coastal communities that rely on fishery for their living are more dependent on a resilient ecosystem.¹¹⁷ Societies whose existence is largely based on subsistence economy may depend less on resilient infrastructures, but on the resilience of the ecosystem and of their community.

Treating critical infrastructure resilience and community resilience as distinct from each other thus misses a crucial point: These two sub-systems are interlinked in such a way that infrastructure resilience cannot be achieved without a resilient community or vice versa. This, however, complicates measurement. To give an example: An indicator commonly suggested to measure the resilience of critical infrastructures is the time it takes until the system is restored after a disruption. But does that mean 100 per cent functionality? Or partial functionality? Moreover, that indicator covers only one part (duration) of the resilience definition employed by the NIAC, the “ability to reduce the magnitude and/or duration of disruptive events”. With regard to community resilience, it is neither easy to imagine what a functioning community after disaster looks like nor to anticipate whether it is possible and even desirable to continue exactly as before. This leads to the second group of difficulties involved in the assessment and measurement of resilience.

Resilience Alliance is also concerned with the social-ecological system, defined as an integrated system in which the dynamics of the social and ecosystem domains are strongly linked and of equal weight.

117 Pine, J. (2010). *Indicators of ecological resilience: Building and sustaining resilient communities*. Paper presented at the International Symposium on Societal Resilience, Fairfax VA, November 30–December 2, 2010.

Quantification of resilience

A second cluster of difficulties in measuring resilience pertains to problems that are inherent in most attempts to capture complex social realities in a few numbers or in a single index. A brief look at the efforts to come up with an index for social vulnerability to disasters, a concept closely related to resilience, exposes some of the core problems:¹¹⁸

Hazard-specific versus multi-hazard assessment: The social vulnerability approach was originally championed as an approach that signified a move away from the exclusive focus on hazards (as opposed to people) in disaster studies.¹¹⁹ It aimed at identifying hazard-independent factors of vulnerability rooted in everyday societal conditions and inequalities, assuming that the same vulnerabilities often make people susceptible to harm from various potential dangers. After some set-backs in multi-hazard measurement, however, some researchers seem to have moved away from this multi-hazard approach, recognizing that even vulnerabilities to disaster that are rooted in socio-economic conditions are very hazard-specific.¹²⁰ With regard to measurement, this implies, of course, that the analysis must also be informed by a great deal of scientific information about hazards.

Data availability: The core problem in all efforts to quantify social vulnerability is that the data needed to come up with a valid measure of the concept is not available. Often, data is not available on a sufficiently low **level of analysis** (village, community), where an

assessment of social vulnerability makes most sense and is most policy-relevant. Additionally, data is not available for some **aspects of vulnerability** that are deemed very important (institutions, social relationships), whereas information on socio-economic factors can be easily obtained, for example, from census statistics. This bears the danger that the concept is “defined and measured by and through the available large databases, such as the census, *because they are there, rather than because these databases encapsulate vulnerability*”.¹²¹ To gather data on aspects that are more difficult to quantify, qualitative assessments are needed. These, however, are time-consuming and often expensive, so that they cannot be repeated sufficiently often to take into account the fact that vulnerability – as well as resilience – **changes over time**.

All these difficulties, familiar to scholars of social vulnerability, can be said to apply equally to resilience. Some of them, however, are magnified by the nature and complexity of the resilience concept. What do we mean by this?

Resilience is a behavior. An analysis of some of the most widely recognized definitions of resilience reveals that many of them put a considerable emphasis on behavioral aspects of a system.¹²² The definition used both by the UN International Strategy for Disaster Reduction (UNISDR) and the US Subcommittee on Disaster Reduction (SDR), for example, defines resilience as “the capacity of a system, community, or society potentially exposed to hazards *to adapt, by resisting or changing*, in order to reach and maintain an acceptable level of functioning and structure.”¹²³ Unlike other disaster-related concepts (such as social

118 The following volume offers a valuable overview of measurement projects in the area of social vulnerability: Birkmann, J. (2006). *Measuring vulnerability to natural hazards: Towards disaster resilient societies*. Tokyo: United Nations University Press.

119 Gaillard, J.C. (2010). *Vulnerability, capacity and resilience: Perspectives for climate and development policy*. *Journal of International Development* 22(2), pp. 218–232.

120 One such set-back is described in: United Nations Development Programme (2004). *Reducing disaster risk: A challenge for development*. New York: UNDP.

121 King, D. (2001). *Uses and limitations of socioeconomic indicators of community vulnerability to natural hazards: Data and disasters in Northern Australia*. *Natural Hazards* 24(2), pp. 147–56. Emphasis by the authors.

122 For an analysis of various resilience definitions, see Plodinec, J. (2009). *Definitions of resilience: An analysis*. Oak Ridge: Community and Regional Resilience Institute (CARRI).

123 UNISDR (2009). *Terminology: Basic terms of disaster risk reduction*. Geneva. Emphasis by the authors.

vulnerability), resilience thus denotes what a society *does* when faced with an extreme event rather than what a society *is*. A resilience index would therefore have to include the characteristics of a system that allow it to behave in a resilient way in the face of disaster. Norris and her colleagues acknowledge this when they describe community resilience as emerging from a set of (adaptive) capacities that enable a community to respond and recover from disasters.¹²⁴

Defining resilience as a behavior rather than a condition additionally complicates some of the methodological difficulties inherent in measuring complex social phenomena. One of them is related to the choice of proxy variables to represent the concept studied.¹²⁵ All indices act as proxies for the concept under examination and as such are merely a “flawed representative of a complex set of events”.¹²⁶ In other words, we can never quantify social reality, but only measure the facts that we think represent it best. However, if resilience is a behavior shaped by a set of capacities, we may be dealing with two levels of proxies here: the capacities identified to be responsible for the resilient behavior of the system (proxies for behavior) and the measures used to represent these capacities (proxies for capacities).

The other methodological problem that is reinforced in measuring resilience is the problem of temporality. An index mirrors the state of a system at a certain point in time and as such is a “snapshot of reality”.¹²⁷ Social realities change quickly, however, and by the time the measurement is repeated, there is no guar-

antee that the indicators chosen to represent the concept are still valid. This is even more pronounced in measuring resilience: If resilience by definition includes the capacity *to adapt* to changing circumstances, a resilient society does not look the same before and after an event. Once the characteristics of a resilient society are defined and “fixed” in an index, this index might miss exactly the adaptation taking place to cope with future disasters.¹²⁸

Resilience is about relationships: It has been pointed out that the dominant understanding of resilience in national security was influenced by engineering resilience and ecosystems resilience. In both those research traditions, resilience is the characteristic of a system (critical infrastructures, community) rather than its individual parts. The distinct feature of resilience is that it is built on *relationships* between the parts of a system (individuals, subgroups, single parts of an infrastructure, teams of an organization, etc.). In brief, resilience is “more than the sum of its parts”, and a collection of resilient individuals does not guarantee a resilient community, nor does the converse apply.¹²⁹ Seeing resilience as a system characteristic greatly reinforces the difficulties involved in measuring it. This is due to the availability and selection of data. While it is often the case in disaster studies that the data most accurately representing the concept under scrutiny is not available, this is more pronounced with resilience, because relational

124 Norris et al., 2008.

125 A proxy variable is an indirect measure of a variable if it is not possible to measure the variable of interest in a direct way. Krauth, J. (2000). *Experimental design: A handbook and dictionary for medical and behavioral research*. Amsterdam: Elsevier. The suicide rate, for example, could serve as a proxy to measure social and emotional well-being in a country – a concept that cannot be observed directly.

126 Cobb, C.W. and C. Rixford (1998). *Lessons learned from the history of social indicators*. Oakland: Redefining Progress, p. 20.

127 Simpson, 2006.

128 In the area of human security, the fact that creating an index pins down a specific understanding of the concept has led to a controversy about whether or not human security should be measured at all. For critics, measuring implies a predetermined definition. Owen writes: “What is included in the measurement necessarily provides a de facto list of what is and is not a human insecurity. For those who are hesitant to limit human security to one definition, this is problematic.” Owen, Taylor (2008). *Measuring human security: Methodological challenges and the importance of geographically referenced determinants*. In: P.H. Liotta et al., *Environmental change and human security*, pp. 35–64.

129 Pfefferbaum, B. et al. (2005). Building resilience to mass trauma events. In: L. Doll et al., *Handbook on injury and violence prevention interventions*. New York: Kluwer Academic Publishers, pp. 347–58.

variables such as social capital, community cohesion, or the interdependencies and redundancies of infrastructures are difficult to measure.

3.3 Measuring resilience: The way forward

The discussion above suggests that a commonly accepted set of indicators or a composite index to measure resilience is a long way off. This is not to say that the efforts to produce policy-relevant “metrics and measurements” for resilience should be abandoned altogether. But what becomes clear in both parts of this focal report is that we simply do not know enough about resilience to be able to quantify it. Maybe resilience researchers need to take a step back and conduct more inductive research to explore the characteristics of a system that strengthen or reduce its resilience. There is a need for more case studies about societies that did or did not show resilient behavior in the face of disaster (judged by conventional wisdom) in order to find out what enabled these societies to react the way they did. This exercise itself will raise some tough questions regarding the policy implications of strengthening resilience, e.g., to what extent resilience can actually be influenced and shaped through government policies and programs. A few examples illustrate this point:

Singapore: In Singapore, as was described in part one of this focal report, community resilience is actively promoted by the government. These efforts are impressive, and the strong focus on societal cohesion on social relations in Singapore’s resilience approach acknowledges that resilience is a property of systems that is shaped by the *relationships* between its parts. However, the government’s efforts to “prescribe” resilience top-down are apparently not uncritically accepted by the society. As a Singaporean scholar pointed out at the resilience symposium in Washington, people in Singapore are a bit wary of “big brother”

telling them how to behave. Moreover, those who accept the approach are the ones already converted.¹³⁰ This raises the question of whether resilience is actually something that can and should be built top-down, or whether it is something communities either do or do not possess on a local level.

Japan: In the face of the massive disaster that hit Japan in the form of an earthquake, a subsequent tsunami, and a nuclear catastrophe in March 2011, many observers highlighted the resilience of the Japanese society, even in this unprecedented catastrophe. They emphasized that those who survived remained disciplined, calm, stoic, polite, waited patiently in long lines, helped each other, and that there was no looting and social turmoil as often seen elsewhere in the wake of such disasters.¹³¹ It was also pointed out, however, that this is an expression of a culturally approved or accepted behavior, “a sense of being first and foremost responsible to the community.”¹³² This highlights that resilience could also have a strong cultural aspect and raises the question to what extent a government would actually want to engage in social engineering to shape these practices.

Israel: The resilience of communities in Israel was a recurrent theme at the resilience symposium in Washington. Israeli scholars, government representatives, and members of the armed forces reported how their local communities have learned to live and cope with recurrent rocket attacks. Their resilience is reflected in the fact that they have chosen to remain in their communities, and that they have adapted their behavior to enhance their own security. Israel is an example of resilience that came about as a result

¹³⁰ Vasu, Norman (2010). *Societal Resilience Regarding Singapore*. Paper presented at the International Symposium on Societal Resilience, Fairfax VA, 30 November – 2 December 2010.

¹³¹ For example: Harvey, R. (17 March 2011). *Earthquake and tsunami test Japan’s resilience*. BBC News; Buerk, R. (18 March 2011). *The moment the earthquake hit in Tokyo*, BBC News.

¹³² Hunter, M. (12 March 2011). *Orderly disaster reaction in line with deep cultural roots*. CNN’s news blog *This Just In*.

of practice and experience over the course of time. Moreover, as was pointed out by the US Principal Deputy Assistant Secretary of Defense for Homeland Defense and Americas' Security Affairs, it is the result of an understanding by the population that they *are*, in fact, constantly under threat. She did then raise the valid question of whether it is really desirable to foster a constant sense of threat in a society in order to be prepared and resilient.¹³³

These few examples demonstrate that there is a lot to gain from detailed case studies, both with regard to what resilience is, and to what extent it can be influenced by policy-makers. Quantifying resilience, then, should be a second priority.

¹³³ Wormuth, C. (2010). *Speech* at the International Symposium on Societal Resilience, Fairfax VA, 30 November – 2 December 2010.

4. IMPLICATIONS FOR SWITZERLAND

Resilience and the somewhat more commonly used German equivalents “Widerstandsfähigkeit” and “Regenerationsfähigkeit” are key concepts in the realm of critical infrastructure protection (CIP) in Switzerland. The Basic Strategy for Critical Infrastructure Protection of 2009 lists resilience as one of the five core principles of CIP, together with an integral approach to risk management, an all-hazards approach to risk analysis, and the principles of maintaining proportionality and subsidiarity in selecting and implementing CIP measures.¹³⁴ Resilience is defined as an aim to “return to a ‘normal’ state as quickly as

possible following an incident,” acknowledging the fact that it is impossible to protect all critical infrastructures permanently or to eliminate all vulnerabilities completely. Resilience consists of the robustness of the system as such (e.g., society, sector, infrastructure element); the availability of redundant units; the ability to mobilize relief efforts; the speed of relief efforts; and the ability of society to handle crisis situations.¹³⁵ In the context of infrastructure protection, resilience is also mentioned in Switzerland’s key national security document, the Swiss Security Policy Report of 2010.¹³⁶

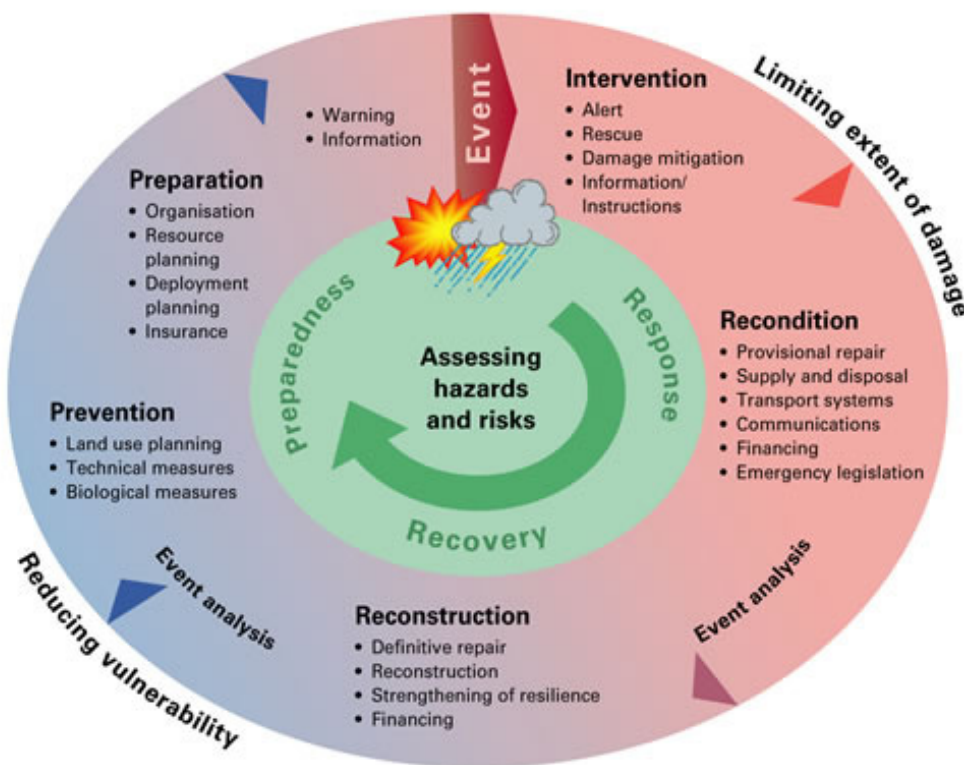


Fig. 8: Disaster management cycle used by the FOCP.¹³⁷

¹³⁴ Federal Council (2009). *The Federal Council’s Basic Strategy for Critical Infrastructure Protection – Basis for the national critical infrastructure protection strategy*. Berne: 18 May 2009.

¹³⁵ For a discussion of some of these points, see Brunner, E. and J. Giroux (2009). *Factsheet: Examining resilience – A concept to improve societal security and technical safety*. Zurich: Center for Security Studies (CSS).

¹³⁶ Federal Council (2010). *Bericht des Bundesrates an die Bundesversammlung über die Sicherheitspolitik der Schweiz*. Berne: 23 June 2010.

The explicit use of the resilience concept in Switzerland is limited to the area of CIP, unlike in the UK, for example, where it is an overarching concept in all areas of national security (see Chapter 2). In a way, however, the integral disaster management approach (see Fig. 8) promoted by the Swiss Federal Office for Civil Protection (FOCP) is inspired by resilience thinking: While prevention and preparation in this cycle correspond to risk management (by definition *before* an event occurs), intervention corresponds to traditional crisis management. Recondition and reconstruction, then, correspond to continuity management and as such are part of a resilience approach that encourages contingency plans in case a disaster cannot be averted.

Notwithstanding the fact that the resilience concept in Switzerland is rarely used explicitly by national security and civil protection policy-makers outside the area of CIP, a case study of Switzerland's resilience after the 2005 floods reveals a number of characteristics of the Swiss system that helped it to cope remarkably well with this disaster.¹³⁸ Among them is a system of financial risk distribution through insurances and public and private funds for non-insurable natural hazards that ensured that the financial impacts of the disaster were not disproportionately felt by single individuals and groups. Most of these financial risk management instruments were created as a result of learning from previous disasters, so that we can actually speak of adaptation reactions – note that adaptive capacity is considered a core characteristic of a resilient system, according to common definitions. Another characteristic of Switzerland that contributed to its resilience was a generally high level of wealth of the Swiss society that allowed most people to independently cope with the

unforeseen events using their individual financial assets. In addition, high social capital or social cohesion in many – especially smaller – villages in Switzerland created a situation in which most people could rely on a social network to support them with money or housing in the time immediately after the disaster. All these factors together contributed to an effective, multi-layered, and multi-actor social safety net that allowed individuals to bounce back rapidly after the 2005 floods and have the financial resources to “go on” with their lives.

The Swiss case offers some interesting insights with regard to an important question raised at the end of Chapter 3, i.e., how and to what extent resilience can actually be influenced and shaped through government policies and programs. One is that resilience in Switzerland is not primarily a result of top-down government programs, but the (unintended) result of a highly decentralized federal system in which responsibilities for disaster management are distributed horizontally (between the local, cantonal, and federal administrative levels) and vertically (between a multiplicity of actors on the same administrative level). This multiplicity of actors has previously been associated with a number of shortcomings of the Swiss civil protection system, such as a lack of standardization of civil protection approaches across cantons, or a lack of operational leadership during crises, especially at the level of the Confederation.¹³⁹ From a resilience perspective, however, decentralized and subsidiary institutional structures may actually contribute to enhanced *flexibility* in disaster response and recovery, which is often associated with resilience.¹⁴⁰ Another

137 FOCP (2003). *Dealing with hazards and risks*.

138 Bara, C. (2010). *Being vulnerable in a resilient community? Some lessons learned from coping with financial loss after the 2005 floods in Switzerland*. Paper presented at the International Symposium on Societal Resilience, Fairfax VA, 30 November – 2 December 2010.

139 Swiss Federal Department for Defence, Civil Protection and Sport (2009). *Herausforderungen des Bevölkerungsschutzes/ Zivilschutzes: Bericht des VBS an die Sicherheitspolitische Kommission des National- und Ständerates, discussed in: Bara, C. and C. Doktor (2010). Focal Report 4 Risk Analysis: Cooperation in civil protection – EU, Spain, and the UK*. Zurich: Center for Security Studies (CSS).

140 As argued for Switzerland by Bollin, C. et al. (2003). *Disaster risk management by communities and local governments*. Washington, D.C.: Inter-American Development Bank.

insight from the Swiss case is that some of the characteristics of a resilient society, e.g., social capital, are difficult to measure, and even more difficult to influence. In the 2005 flood in Switzerland, social capital resulted from the fact that in many of the affected villages, people knew each other and the authorities personally and supported each other. It is doubtful whether such factors can realistically be influenced through government programs, though Singapore does go in that direction with its top-down policy of fostering “racial” harmony and good neighborhood relations through housing quota and other factors.

With regard to the measurement of resilience, the current efforts by the international research and policy community raise the question of whether the FOCP should join in those efforts to come up with a set of resilience indicators. We believe it is too early for that. Before resilience can be quantified, it is crucial to have a clearer understanding of the many factors that contribute to or reduce the resilience of a system. In CIP, the key challenges are interdependencies of infrastructures and cascading effects, a point the FOCP already accounts for in its assessment of the criticality of infrastructure sub-sectors.¹⁴¹ On a societal level, these interdependencies pertain to the many linkages between the resilience of communities, individuals, organizations, infrastructures, and the ecosystem. Because of its size, Switzerland is an ideal case for examining those interdependencies and interactions in more detail.

¹⁴¹ FOCP, *Critical Infrastructures*.

5. ANNOTATED BIBLIOGRAPHY

5.1 Government documents and resources

US

Critical Infrastructure Resilience: Final Report and Recommendations. National Infrastructure Advisory Council (NIAC), 2009. URL: http://www.dhs.gov/xlibrary/assets/niac/niac_critical_infrastructure_resilience.pdf. Archived by WebCite® at <http://www.webcitation.org/5y1pzjBki>.

The report by the National Infrastructure Advisory Council (NIAC) emphasized the importance of critical infrastructure resilience as necessary for government and business to create a comprehensive risk-management strategy. It recommends steps to be taken in order for government and industry to integrate resilience and protection into a comprehensive risk-management strategy. The focus is on critical infrastructure resilience.

FEMA Strategic Plan, Fiscal Years 2008–2013: The Nation’s Preeminent Emergency Management and Preparedness Agency, 2008, http://www.fema.gov/pdf/about/fyo8_fema_sp.pdf. Archived by WebCite® at <http://www.webcitation.org/5yJ3SX6f7>.

With its plan, the Federal Emergency Management Agency (FEMA), as the leading emergency management agency, sets the standard for emergency management across the US, and fosters information and relationship-building across the emergency management sector (engaging with entities at the federal, state, and local areas) in the areas of disaster, emergencies, and terrorist events.

FEMA Strategic Plan, Fiscal Years 2011–2014, 2011, http://www.fema.gov/pdf/about/strategic_plan11.pdf. Archived by WebCite® at <http://www.webcitation.org/5yJ3cX4Yv>.

With its updated plan, the Federal Emergency Management Agency (FEMA), as the leading emergency management agency, sets the standard for emergency management across the US, fosters information and relationship-building across the emergency management sector (engaging with entities at the federal, state and local areas) in the areas of disaster, emergencies and terrorist events. The focus has shifted since the previous plan: Now, community resilience (“individuals, families, and communities”) are the plan’s main focus.

National Infrastructure Protection Plan (NIPP): Partnering to enhance protection and resiliency, DHS, 2009. http://www.dhs.gov/xlibrary/assets/NIPP_Plan.pdf. Archived by WebCite® at <http://www.webcitation.org/5y1tYkMY9>.

The NIPP – with its “overarching goal [...] to build a safer, more secure, and more resilient America” provides a unifying structure for the integration of existing and future CIKR protection efforts and resilience strategies into a single national program. It also lists the parties responsible for CIP, the legal framework, and specific future strategies for all parties involved in CIP.

National Response Framework (NRF), DHS, 2008. <http://www.fema.gov/pdf/emergency/nrf/nrf-core.pdf>. Archived by WebCite® at <http://www.webcitation.org/5y1uPNmga>.

The NRF is a guide to how the US conducts all-hazards response in emergency management, linking all levels of government. The intended audience of the framework includes government executives, private-sector and nongovernmental organization (NGO) leaders, as well as emergency management practitioners. It defines roles and responsibilities on all government and local levels, it lists response actions, describes the nation’s organizational structure

in emergency response, and lastly, it emphasizes the importance of professional emergency planning.

National Security Strategy, The White House, Washington DC, 2010. URL: http://www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf Archived by WebCite® at <http://www.webcitation.org/5y1rJPam3>.

The National Security Strategy is the overarching strategy paper defining US security interests and actions at home and abroad. Preparedness and resilience – the “commitment to building a secure and resilient nation” – are central elements of the strategy.

Presidential Policy Directive / PPD-8: National Preparedness. DHS, The White House, 30 March 2011, http://www.dhs.gov/xabout/laws/gc_1215444247124.shtm Archived by WebCite® at <http://www.webcitation.org/5y1tFMcyf>.

The Presidential Policy Directive “National Preparedness” calls for the development of a “national preparedness goal” (to be submitted to the president within the following 180 days by the Secretary of Homeland Security) and the creation of a “national preparedness system” (to be submitted and described within the following 240 days). The goal of these measures is “strengthening the security and resilience of the United States through systematic preparation for the threats that pose the greatest risk to the security of the Nation, including acts of terrorism, cyber attacks, pandemics, and catastrophic national disasters.”

Quadrennial Homeland Security Review Report: A Strategic Framework for a Secure Homeland. DHS, Washington, D.C., 2010. URL: http://www.dhs.gov/xlibrary/assets/qhsr_report.pdf. Archived by WebCite® at <http://www.webcitation.org/5y1s2KsqN>.

The Quadrennial Homeland Security Review Report by the DHS functions as a strategic document that seeks to answer the most fundamental questions about homeland security. It describes a homeland

security vision for the US and the requisite set of key mission areas, goals, objectives, and outcomes. Its purpose is to “serve as a roadmap to keep America safe, secure, and resilient in the years ahead.”

UK

Civil Contingencies Act 2004 http://www.legislation.gov.uk/ukpga/2004/36/pdfs/ukpga_20040036_en.pdf. Archived by WebCite® at <http://www.webcitation.org/5yJ6WknjZ>.

The Civil Contingencies Act defines local arrangements for civil protection in all of the UK. It establishes a coherent framework for emergency planning and response, from the local to the national level. The Act was important for introducing the concept of resilience (see “Emergency Preparedness: Guidance on Part 1 of the Civil Contingencies Act 2004 below).

Emergency Preparedness: Guidance on Part 1 of the Civil Contingencies Act 2004, its associated Regulations and non-statutory arrangements, 2005, <http://www.cabinetoffice.gov.uk/sites/default/files/resources/emergprepfinal.pdf> Archived by WebCite® at <http://www.webcitation.org/5yJ77Y6fh>.

In the Emergency Preparedness Guidance on the Civil Contingencies Act 2004, the steps to be taken for a new coherent framework for emergency planning and response in the UK are spelled out. The goal: Integrated Emergency Management (IEM). The importance of the concept of resilience in emergency management is established: “The wide concept of IEM within and across Category 1 responders is geared to the idea of building greater overall resilience in the face of a broad range of disruptive challenges.” The Guidance describes the steps for building Local Resilience Forums (LRF) throughout the UK.

A strong Britain in an Age of Uncertainty: The National Security Strategy of the United Kingdom, 2010, http://www.direct.gov.uk/prod_consum_dg/groups/dg_digitalassets/@dg/@en/documents/digitalasset/dg_191639.

pdf. Archived by WebCite® at <http://www.webcitation.org/5y14ju4JT>.

The United Kingdom's National Security Strategy identifies the key risks and threats – terrorism, nuclear weapons, organized crime, failed states, civil emergencies – as well as the main drivers for future insecurities (such as climate change, energy dependency, economic developments) and lists the government's response for each of the areas identified. Building resilience on all levels (government and society) is one of the strategy's key goals.

Strategic Framework and Policy Statement on Improving the Resilience of Critical Infrastructure to Disruption from Natural Hazards, Cabinet Office, 2010, <http://www.cabinetoffice.gov.uk/sites/default/files/resources/strategic-framework.pdf> Archived by WebCite® at <http://www.webcitation.org/5y17vY18G>.

A new framework concerning natural hazard mitigation strategies: The Strategic Policy Framework and Policy Statement on Improving the Resilience of Critical Infrastructure to Disruption from natural hazards is a systematic, coordinated, cross-sector campaign to reduce the disruption caused by natural events to critical infrastructure and essential services. The framework's goal is to improve the resilience of critical infrastructure and essential services by proposing cross-sector programs.

Australia

Assessing Resilience and Vulnerability in the Context of Emergencies: Guidelines, Australian Department of Human Services, Victorian Government Publishing Service, 2000, http://www.proventionconsortium.org/themes/default/pdfs/CRA/Victorian_government_2000_meth.pdf Archived by WebCite® at <http://www.webcitation.org/5yNHJNldG>.

A collection of guidelines for the Australian emergency services, to be used at local and community levels by municipalities, agencies and organizations, as well as by the community itself. The guidelines are

intended to assist in determining the resilience and the vulnerabilities of the local community in terms of the risks which they face.

Buckle, P., G. Marsh, et al. (2001). Assessing Resilience & Vulnerability: Principles, Strategies & Actions. Guidelines prepared for Emergency Management Australia. 2001, http://www.proventionconsortium.org/themes/default/pdfs/CRA/EMA_2001_meth.pdf. Archived by WebCite® at <http://www.webcitation.org/5yNHBECTS>.

A collection of guidelines for enhancing resilience in emergency management contexts aimed principally at assessing the resilience and vulnerability of individuals, small groups, and small communities.

Building Inclusive and Resilient Communities, Australian Social Inclusion Board, 2009. <http://www.socialinclusion.gov.au/LatestNews/Documents/Buildingcommunityresiliencebrochure.pdf> Archived by WebCite® at <http://www.webcitation.org/5yNMSPRyr>.

A short guide containing suggestions for assessing and building community resilience in Australia.

Counter-Terrorism White Paper: Securing Australia/ Protecting our Community, 2010, http://www.dpmc.gov.au/publications/counter_terrorism/docs/counter-terrorism_white_paper.pdf Archived by WebCite® at <http://www.webcitation.org/5yNlfYX3s>.

Australia's Counter Terrorism Whitepaper focuses mainly on deterrence on Australian soil, guided by four essential steps: Analysis, Protection, Response, and Resilience.

Critical Infrastructure Resilience Strategy, Australian Government, 2010. [http://www.ag.gov.au/www/agd/rwpattach.nsf/VAP/%289A5D88DBA63D32A661E6369859739356%29~Australian+Government+s+Critical+Infrastructure+Resilience+Strategy.PDF/\\$file/Australian+Government+s+Critical+Infrastructure+Resilience+Strategy.PDF](http://www.ag.gov.au/www/agd/rwpattach.nsf/VAP/%289A5D88DBA63D32A661E6369859739356%29~Australian+Government+s+Critical+Infrastructure+Resilience+Strategy.PDF/$file/Australian+Government+s+Critical+Infrastructure+Resilience+Strategy.PDF) Archived by WebCite® at <http://www.webcitation.org/5yNJFowfv>.

National CIP strategy, with a strong focus on resilience. The First National Security Statement to the Parliament: Address by the Prime Minister of Australia, The Hon. Kevin Rudd MP, 2008 http://www.iseas.edu.sg/aseanstudiescentre/ascd/f3_Rudd_NatSec_041209.pdf Archived by WebCite® at <http://www.webcitation.org/5yNIMgQYN>.

Australia's prime minister describes the scope of national security; national security interests, principles, and priorities; and the government's vision for a reformed national security structure – putting a strong emphasis on resilience.

National Disaster Resilience Framework, 2010. [http://www.ema.gov.au/www/emaweb/rwpattach.nsf/VAP/%28C7C220BBE2D77410637AB17935C2BD2E%29~NationalDisasterResilienceFramework-EndorsedatMCPEM-EM20Nov2009.pdf/\\$file/NationalDisasterResilienceFramework-EndorsedatMCPEM-EM20Nov2009.pdf](http://www.ema.gov.au/www/emaweb/rwpattach.nsf/VAP/%28C7C220BBE2D77410637AB17935C2BD2E%29~NationalDisasterResilienceFramework-EndorsedatMCPEM-EM20Nov2009.pdf/$file/NationalDisasterResilienceFramework-EndorsedatMCPEM-EM20Nov2009.pdf) by WebCite® at <http://www.webcitation.org/5yNLuFVgQ>.

Building on the 2008 decision by the Ministerial Council for Police and Emergency Management that the future direction of Australian policy should be resilience-oriented, this framework seeks to strengthen communities, individuals, businesses, and institutions to minimize the adverse effects of disasters on Australia.

National Strategy for Disaster Resilience: Building our nation's resilience to disasters, 2011, http://www.coag.gov.au/coag_meeting_outcomes/2011-02-13/docs/national_strategy_disaster_resilience.pdf Archived by WebCite® at <http://www.webcitation.org/5yNJZqNyg>.

This strategy advocates risk thinking and methods across Australia's "social, built, economic and natural environments" in emergency management in order to increase disaster resilience.

Canada

Action Plan for Critical Infrastructure, 2009. http://www.publicsafety.gc.ca/prg/em/ci/_fl/ct-pln-eng.pdf

Archived by WebCite® at <http://www.webcitation.org/5yNPPJ274>.

The Action Plan for Critical Infrastructure supports the National Strategy for Critical Infrastructure (see below). It advocates sustainable partnerships with federal, provincial, and territorial governments and critical infrastructure sectors, improved information-sharing and protection; and a commitment to all-hazards risk management for enhanced resilience in CIP.

Canada's National Disaster Mitigation Strategy, 2008. http://www.publicsafety.gc.ca/prg/em/ndms/_fl/NDMS_Web_E.pdf. Archived by WebCite® at <http://www.webcitation.org/5yNS1Awv>.

The strategy "set[s] out a common vision for disaster mitigation activities in Canada". One of the goals of the long-term effort outlined in the strategy is "to develop sustainable, disaster resilient communities across Canada."

Chemical, Biological, Radiological, Nuclear and Explosives Resilience Strategy for Canada, 2011. http://www.publicsafety.gc.ca/prg/em/_fl/cbrne-res-str-eng.pdf. Archived by WebCite® at <http://www.webcitation.org/5yNZjGvdg>.

Strategy aimed at achieving resilience to the risks and threats of CBRNE events. It is based on five strategic objectives: Leadership, Risk Management, Capability based Planning, Effective and Interoperable Workforce, and Information and Knowledge Management.

An Emergency Management Framework for Canada, Second Edition, 2011. http://www.publicsafety.gc.ca/prg/em/_fl/emfrmwrk-2011-eng.pdf Archived by WebCite® at <http://www.webcitation.org/5yNR8liir>.

The federal, provincial, and territorial (FPT) governments produced this Emergency Management Framework for Canada, establishing a common approach for the various FPT emergency management initiatives. This second edition adds the concepts of resilience and an all-hazards approach to Canadian Emergency Management.

Emergency Management Planning Guide, 2010–2011. http://www.publicsafety.gc.ca/prg/em/emp/_fl/emp-gd-2010-11-e.pdf. Archived by WebCite® at <http://www.webcitation.org/5yNTQF7U2>.

This guide offers tools and detailed information on how to make efficient emergency management plans. It aims at making emergency management professionals and agencies more effective, thereby enhancing resilience.

Federal Emergency Response Plan, 2009. http://www.publicsafety.gc.ca/prg/em/_fl/ferp-eng.pdf. Archived by WebCite® at <http://www.webcitation.org/5yNXq6EL9>.

The Federal Emergency Response Plan outlines the processes and mechanisms to facilitate an integrated Government of Canada response to an emergency. Though the concept of resilience is not mentioned, the plan explicitly ties in with the Federal Policy for Emergency Management as well as Canada's National Security Policy.

Federal Policy for Emergency Management, 2009. http://www.publicsafety.gc.ca/prg/em/_fl/fpem-12-2009-eng.pdf Archived by WebCite® at <http://www.webcitation.org/5yNSoAhWO>.

The Federal Policy for Emergency Management promotes “an integrated and resilient whole-of-government approach to emergency management planning, which includes better prevention/mitigation of, preparedness for, response to, and recovery from emergencies.”

National Strategy for Critical Infrastructure, 2009. http://www.publicsafety.gc.ca/prg/em/ci/_fl/ntnl-eng.pdf Archived by WebCite® at <http://www.webcitation.org/5yNOrBYf7>.

The National Strategy for CIP advocates a combination of security measures to address intentional and accidental incidents, business continuity practices to deal with disruptions, and emergency management planning in order to enhance resilience.

Securing an Open Society: Canada's National Security Policy. 2004, <http://www.pco-bcp.gc.ca/docs/information/publications/natsec-secnat/natsec-secnat-eng.pdf> Archived by WebCite® at <http://www.webcitation.org/5yNMweYuo>.

In this national security policy, the concept of resilience is only used in the context of national public health concerns.

Germany

Grundsatzpapier: Strategie für einen modernen Bevölkerungsschutz, 2009. http://www.bmi.bund.de/SharedDocs/Downloads/DE/Themen/Sicherheit/BevoelkerungKrisen/grundsatzstrategie_moderner_bevoelkerungsschutz.pdf?__blob=publicationFile. Archived by WebCite® at <http://www.webcitation.org/5yNeSgRu6>.

One year after the formation of the department for “Krisenmanagement und Bevölkerungsschutz“ in the German Interior Ministry, this strategy paper lists all important new findings, risks, and challenges in civil protection.

Nationale Strategie zum Schutz Kritischer Infrastrukturen (KRITIS-Strategie), 2009. http://www.bmi.bund.de/SharedDocs/Downloads/DE/Broschueren/2009/kritis.pdf?__blob=publicationFile. Archived by WebCite® at <http://www.webcitation.org/5yNaS2V2W>.

Strategy paper about CIP in Germany, providing definitions, a list of risks addressed (from natural hazards to terrorism and war), and advocating a risk culture of shared responsibility between the government and the private sector.

Neue Strategie zum Schutz der Bevölkerung in Deutschland, 2010. http://www.bbk.bund.de/nn_398010/SharedDocs/Publikationen/Wissenschaftsforum/Band-4__NeueStrategie,templateId=raw,property=publicationFile.pdf/Band-4__NeueStrategie.pdf. Archived by WebCite® at <http://www.webcitation.org/5yNdCCWLU>.

The new strategy for civil protection advocates an

optimized cooperation between all government levels in overcoming disasters of national impact. It introduces a standard method for risk analysis, and a modern concept for equipment in cases of mass casualties and CBRN threats, a better information and warning system, as well as scenarios and exercises.

Schutz Kritischer Infrastrukturen – Basisschutzkonzept: Empfehlungen für Unternehmen, 2005. http://www.bbk.bund.de/cln_028/nn_402322/SharedDocs/Publikationen/Publikationen_20Kritis/Basisschutzkonzept_Kritis,templateId=raw,property=publicationFile.pdf/Basisschutzkonzept_Kritis.pdf Archived by WebCite® at <http://www.webcitation.org/5yNb5CQ9Y>.

The “Basisschutzkonzept” for businesses makes recommendations for CIP from a national security perspective. There is also a chapter on risk and business continuity management.

Schutz Kritischer Infrastrukturen – Risiko- und Krisenmanagement (Leitfaden für Unternehmen und Behörden), 2008. http://www.bmi.bund.de/SharedDocs/Downloads/DE/Broschueren/2008/Leitfaden_Schutz_kritischer_Infrastrukturen.pdf?__blob=publicationFile. Archived by WebCite® at <http://www.webcitation.org/5yNc93A09>.

The “Leitfaden Risiko- und Krisenmanagement” lists various methods for installing risk and crisis management for CI managers, providing examples and checklists. The practically oriented report is based on the recommendations of the CIP “Basisschutzkonzept” (2005, see above).

Singapore

Civil Defence Emergency Handbook, 2010. http://www.scdf.gov.sg/content/scdf_internet/en/community-and-volunteers/publications/jcr_content/par/download_cdc1/file.res/EmergencyHandbook2010Edition_English.pdf. Archived by WebCite® at <http://www.webcitation.org/5yNhkT1Tw>.

The Civil Defence Emergency Handbook is part of the

Singaporean government’s effort to increase social resilience. The extensive handbook serves to educate the public about threats and risks, ranging from emergency management and first aid procedures to wartime emergencies and terrorist attacks.

Fact Sheet: Infocomm Security Masterplan 2, 2008. http://www.ida.gov.sg/doc/News%20and%20Events/News_and_Events_Level2/20080417090044/MR17Apr08MP2.pdf. Archived by WebCite® at <http://www.webcitation.org/5yNgU3A8I>.

The second Infocomm Security Masterplan is a five-year roadmap towards enhancing the resilience against cyber-attacks. It makes a strong case for cooperation between government, private companies, and society.

The Fight Against Terror: Singapore’s National Security Strategy, The National Security Coordination Centre, 2004. <http://merln.ndu.edu/whitepapers/singapore-2004.pdf>. Archived by WebCite® at <http://www.webcitation.org/5yNg4gBKD>.

Singapore’s strategy against transnational and possible national terrorism lists all the current threats and risks and the government’s strategy against them. It also contains a practical part (Prevention/Protection/Response). One of the key goals is enhancing the nation’s resilience against terrorism.

Total Defence: Protecting the Singaporean Way of Life, 2010. http://www.totaldefence.sg/content/imindef/mindef_websites/topics/totaldefence/about_td/5_Pillars/jcr_content/imindefPars/0012/file.res/TD_Booklet_30Dec2008.pdf. Archived by WebCite® at <http://www.webcitation.org/5yNh9AbhC>.

A booklet explaining the five pillars (Military, Civil, Economic, Social, and Psychological) of the Singaporean defense program “Total Defence”.

Israel (academic literature only)

Civil Resilience Network: Conceptual Framework for Israel's Local & National Resilience. The Reut Institute, 2009. <http://reut-institute.org/data/uploads/Articles%20and%20Reports%20from%20other%20organizations/20091026%20-%20Resilience%20Network%20-%20Version%20B%20FV%20with%20links.pdf> Archived by WebCite® at <http://www.webcitation.org/5yNllsAWs>.

A paper arguing in favor of much more social resilience programs for Israel and the furthering of a “culture of preparedness”. Specific steps advocated: the foundation of “civil resilience networks”.

Elran, Meir: A Home Front Law For Israel. In: *Strategic Assessment*, 13/4, January 2011, p. 55. [http://www.inss.org.il/upload/\(FILE\)1295870251.pdf](http://www.inss.org.il/upload/(FILE)1295870251.pdf). Archived by WebCite® at <http://www.webcitation.org/5yNjZVL6J>.

A proposal for a comprehensive and all-encompassing Home Front law for Israel, which is still lacking despite numerous national security programs and services.

Ganor, Boaz: A New Strategy Against The New Terror. In: *Policy View*, 10/1995, <http://212.150.54.123/articles/articledet.cfm?articleid=4>. Archived by WebCite® at <http://www.webcitation.org/5yNkcopig>.

Strategy proposal against terrorism, highlighting the importance of “educating the public to be familiar with the terrorists’ strategy, which will frustrate the achievement of their goal – the instilling of fear and lack of personal security.”

Shabtai, Shay. Israel's National Security Concept: New Basic Terms in the Military Security Sphere. In: *Strategic Assessment*, 13/2, August 2010. [http://www.inss.org.il/upload/\(FILE\)1283413333.pdf](http://www.inss.org.il/upload/(FILE)1283413333.pdf). Archived by WebCite® at <http://www.webcitation.org/5yNjT2dR1>.

An explanation of Israel's National Security Concept. The paper argues for the need to radically transform its security strategy in order to be ready for current and future threats.

International governmental and non-governmental organizations

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, 18–20 January 2005, Kobe, Hyogo, Japan). URL: <http://www.unisdr.org/eng/hfa/hfa.htm>, archived by WebCite® at <http://www.webcitation.org/5y5EYU6U5>.

The World Conference on Disaster Reduction was held from 18 to 22 January 2005 in Kobe, Hyogo, Japan, and adopted the present Framework for Action 2005–2015. The conference provided an opportunity to promote a strategic and systematic approach to reducing vulnerabilities and risks to hazards. It underscored the need for, and identified ways of, building the resilience of nations and communities to disasters.

International Federation of Red Cross and Red Crescent Societies (IFRC), *World Disasters Report: Focus on community resilience* (Geneva: IFRC, 2004).

The focus of the 2004 World Disasters Report, in its 12th year of publication, is on community resilience. The report puts the focus on strengthening resilience, rather than just reducing vulnerability, in order to avoid portraying disaster-affected communities as helpless victims dependent on outside aid. It explores what enables people to survive, adapt, and bounce back from crisis, what power relations and inequalities influence this process, and what resources are available within communities to build on those strengths. It focuses on the most important resource for managing disasters: people's own strategies to cope and adapt.

5.2 Online resources

Community and Regional Resilience Institute (CARRI). URL: <http://www.resilientus.org/>, archived by WebCite® at <http://www.webcitation.org/5y5KaO7A2>.

CARRI is a collaborative effort between the US Department of Homeland Security (Science and Technology Directorate), Oak Ridge National Laboratory, and a number of academic institutions. It is dedicated to research and practical application across the full continuum of prevention, protection, response, and recovery to enhance the resilience of communities and regions. In addition to providing information and publications on various resilience-related topics, the website also features a blog and an events calendar.

Cranfield University Resilience Centre. URL: <http://www.cranfield.ac.uk/cds/resiliencecentre/>, archived by WebCite® at <http://www.webcitation.org/5y5LDUdBn>.

This website provides information on various resilience-related educational and training opportunities, applied research, and consultancy services.

Enhancing Critical Infrastructure Resilience, 2010. Blog article by Todd M. Keil, Assistant Secretary for Infrastructure Protection <http://blog.dhs.gov/2010/12/enhancing-critical-infrastructure.html>, archived by WebCite® at <http://www.webcitation.org/5ylsrnlyp>.

The DHS blog provides insights into ongoing and planned policy programs. In this particular blog entry, some current programs concerning CIP are presented and discussed.

The Home Front Command. URL: <http://www.oref.org.il/14-en/PAKAR.aspx>. Archived by WebCite® at <http://www.webcitation.org/5yNikUX4h>.

The official English version website of Israel's Home Front Command, listing all risks and threats and methods/programs for dealing with them.

International Symposium on Societal Resilience. URL: <https://www.signup4.net/Public/ap.aspx?EID=HOME58E>,

archived by WebCite® at <http://www.webcitation.org/5y5KOrpdo>.

This website offers information on the first International Symposium on Societal Resilience held from 30 November to 2 December 2010, in Fairfax, Virginia. It contains a [link](#) to video clips of all the keynote speakers and distinguished researchers' presentations.

Israel's National Security Council. <http://www.nsc.gov.il/NSCWeb/TemplatesEnglish/HomePageEN.aspx>. Archived by WebCite® at <http://www.webcitation.org/5yNjzhJF>.

The official website of the National Security Council of Israel offers current terrorist warnings and publications on issues of national security.

Ready America: Prepare, Plan, Stay Informed. URL: <http://www.Ready.gov> Archived by WebCite® at <http://www.webcitation.org/5ylqoV1b4>.

Ready.gov is the home of the US Department of Homeland Security Ready campaign, which aims at building societal resilience by providing educational resources for individuals, businesses, and communities. Ready.gov is geared towards enhancing prevention activities and creating awareness about emergencies.

Resilience Alliance (RA). URL: <http://www.resalliance.org/>, archived by WebCite® at <http://www.webcitation.org/5y5JzHs9Z>.

The Resilience Alliance is a research organization comprised of scientists and practitioners from many disciplines who collaborate to explore the dynamics of social-ecological systems. The website offers information on key concepts in research on social-ecological systems, such as resilience, adaptability, and transformability, provides access to case studies and research papers, and contains an extensive bibliography of social-ecological systems research.

Resilience Engineering Network (R.E.N.). URL: <http://www.resilience-engineering.org/>, archived by WebCite® at <http://www.webcitation.org/5y5JumlM5>.

The Resilience Engineering Network is an open organization of people and institutions that are engaged in the development and application of resilience engineering. The purpose of the network is to facilitate the communication and distribution of ideas and results pertaining to resilience engineering, as well as to pool resources.

Stockholm Resilience Centre. URL: <http://www.stockholmresilience.org/>, archived by WebCite® at <http://www.webcitation.org/5y5LmFKaj>.

The Stockholm Resilience Centre seeks to advance transdisciplinary research for governance of social-ecological systems with a special emphasis on resilience. The website offers information on research activities and a searchable database of the center's publications.

The CIP Report. URL: <http://cip.gmu.edu/the-cip-report>, archived by WebCite® at <http://www.webcitation.org/5y5KwXOpv>.

The CIP Report is a monthly, electronic newsletter for professionals in industry, government, and academia who have an interest in Critical Infrastructure Protection (CIP). The newsletter provides the latest information about CIP including emerging legislation, government initiatives and leaders, and academic endeavours, and often features articles on and related to resilience not limited to CIP. The CIP Report is published by the Center for Infrastructure Protection and Homeland Security at George Mason University.

5.3 Academic literature

General: Resilience definitions and frameworks

Ahmed, Atiq Kainan (2006). *Concepts and practices of “resilience”: A compilation from various secondary sources.* A Working Paper Prepared for the Coastal Community Resilience (CCR) Program. Bangkok: U.S. Indian Ocean Tsunami Warning System (IOTWS) Program. URL: <http://www.adpc.net/v2007/programs/ews/CCR/downloads/CCRConceptsandPracticesofResilience.pdf>, archived by WebCite® at <http://www.webcitation.org/5yEb6fP7w>.

This document is a compilation of resilience definitions, frameworks, and models by scholars as well as by governmental and non-governmental organizations.

Aven, Terje (2011). *On some recent definitions and analysis frameworks for risk, vulnerability, and resilience.* *Risk Analysis* 31(4), pp. 515–22.

This article takes a critical look at the systems-based approach to risk, vulnerability, and resilience analysis. In the systems-based approach, it is argued that risk, vulnerability, and resilience are inherently and fundamentally functions of the states of the system and its environment. Vulnerability is defined as the manifestation of the inherent states of the system, whereas resilience is defined as the ability of the system to withstand a major disruption within acceptable degradation parameters and to recover within an acceptable time, and composite costs, and risks. Risk, on the other hand, is defined by the probability and severity of adverse effects. The author observes that the key concepts are inconsistent in the sense that the uncertainty (probability) dimension is included for the risk definition, but not for vulnerability and resilience. In the article, he questions the rationale for this inconsistency and presents an alternative framework that provides a logically defined structure for risk, vulnerability, and resilience, where all three concepts

are incorporating the uncertainty (probability) dimension.

Brunner, Elgin and Jennifer Giroux (2009). *Factsheet: Examining resilience – A concept to improve societal security and technical safety*. Zurich: Center for Security Studies (CSS). URL: <http://www.isn.ethz.ch/isn/Digital-Library/Publications/Detail/?id=105745&lng=en>.

This factsheet examines some current definitions of and conceptual approaches to resilience. Additionally, it highlights the difference between resilience and another commonly used term, redundancy. Components of the resilience of critical infrastructures and society, respectively, are addressed and illustrated using some concrete examples of how states and international organizations are incorporating resilience into their security strategies.

Kahan, Jerome K., Andrew C. Allen and Justin K. George (2009). *An operational framework for resilience*. *Journal of Homeland Security and Emergency Management* 6(1).

This article offers an operational framework for incorporating resilience into infrastructure and society in order to make the nation safer. The authors use a systemic approach that encompasses both “hard” systems (such as infrastructures and assets) and “soft” systems (such as communities and individuals).

Plodinec, John (2009). *Definitions of resilience: An analysis*. Oak Ridge: Community and Regional Resilience Institute (CARRI).

URL: http://www.resilientus.org/library/CARRI_Definitions_Dec_2009_1262802355.pdf, archived by WebCite® at <http://www.webcitation.org/5yEaWudwu>.

This document presents the results of an examination of literature to identify definitions of resilience in several domains (e.g., physical, ecological, community, individual, economic). It contains an analysis and classification of these definitions along the core concepts they have in common.

Resilience of ecosystems and social-ecological systems

Adger, W. Niel (2000). *Social and ecological resilience: are they related?* *Progress in Human Geography* 24(3), pp. 347–64.

This article defines social resilience as the ability of groups or communities to cope with external stresses and disturbances as a result of social, political, and environmental change. This definition highlights social resilience in relation to the concept of ecological resilience, or the ability of ecosystems to maintain themselves in the face of disturbance. There is a clear link between social and ecological resilience, particularly for social groups or communities that are dependent on ecological and environmental resources for their livelihoods. But it is not clear whether resilient ecosystems enable resilient communities in such situations. This article examines whether resilience is a useful characteristic for describing the social and economic situation of social groups and explores potential links between social resilience and ecological resilience.

Duit, Andreas, Victor Galaz, Katarina Eckerberg and Jonas Ebbesson (2010). *Governance, complexity, and resilience*. *Global Environmental Change* 20(3), pp. 363–8.

This article is an introduction to a special issue to explore novel multilevel governance challenges posed by the behavior of dynamic and complex social-ecological systems. The authors expand and investigate the emerging notion of resilience as a perspective for understanding how societies can cope with, and develop from, disturbances and change. As the contributions to the special issue illustrate, resilience thinking in its current form contains substantial normative and conceptual difficulties for the analysis of social systems. However, a resilience approach to governance issues also shows a great deal of promise as it enables a more refined understanding of the dynamics of rapid, interlinked, and multiscale change.

Folke, Carl (2006). *Resilience: The emergence of a perspective for social-ecological systems analyses*. *Global Environmental Change* 16(3), pp. 253–67.

This article presents the origin of the resilience perspective and provides an overview of its development to date, acknowledging that the resilience perspective is increasingly used as an approach for understanding the dynamics of social-ecological systems. With roots in one branch of ecology and the discovery of multiple basins of attraction in ecosystems in the 1960s and 1970s, it inspired social and environmental scientists to challenge the dominant stable equilibrium view. Serious attempts to integrate the social dimension are currently being made in resilience work, as reflected in the large numbers of sciences involved in explorative studies and new discoveries of linked social-ecological systems.

Holling, C.S. (1973). *Resilience and stability of ecological systems*. *Annual Review of Ecology and Systematics* 4, pp. 1–23.

This seminal paper on the resilience of ecosystems had a durable impact on resilience research both within ecology and other natural and social sciences. In this paper, the author defined resilience as the magnitude of disturbance that a system can experience before it shifts into a different state.

Organizational/Enterprise resilience

Erol, Ozgur, Devanandham Henry, Brian Sauser and Mo Mansouri (2010). *Perspectives on measuring enterprise resilience*. Paper presented at the 4th Annual IEEE Systems Conference, 5–8 April 2010. URL: http://www.stevens.edu/csr/fileadmin/csr/Publications/Erol_et_al._IEEE_systems_conference_2010_FINAL-1.pdf, archived by WebCite® at <http://www.webcitation.org/5yGCdaD6O>.

Although there is a good amount of scholarly literature defining resilience in various disciplines, there are only few publications that specifically focus on enterprise resilience. In this paper, however, the au-

thors go beyond resilience definitions and into the practice of resilience engineering, which suggests the development of tools and methodologies to analyze, measure, and monitor the resilience of organizations. They review the existing methodologies of measuring resilience and attempt to provide a foundation to develop a comprehensive methodology for measuring enterprise resilience.

Gibson, Carl A. and Michael Tarrant (2010). *A ‘conceptual models’ approach to organisational resilience*. *Australian Journal of Emergency Management* 25(2), pp. 6–12.

This paper presents a number of conceptual models of organizational resilience that the authors have developed to demonstrate the range of interdependent factors that need to be considered in the management of risks to organizations. These conceptual models illustrate that effective resilience is built upon a range of different strategies that enhance both “hard” and “soft” organizational capabilities. They emphasize that there is no quick fix and no single process, management system, or software application that will create resilience.

Parker, Rita (2011). *Mitigating disruptions through organisational resilience*. In: *The CIP Report 9/8*. Arlington, VA: Center for Infrastructure Protection and Homeland Security. URL: http://cip.gmu.edu/archive/CIPHS_TheCIPReport_February2011_Resilience.pdf, archived by WebCite® at <http://www.webcitation.org/5yGD88oYf>.

In this article, the author discusses organizational resilience as a critical nexus between national and community resilience in mitigating disruptions. She points out that each is, in some way, dependent on the other because resilience demands partnerships and interdependencies within and across social, corporate, and national boundaries. Resilient organizations are pivotal for a nation’s security, progress, and well-being. These organizations, in turn, are made up

of the same people critically affected by the level of, or absence of, community resilience.

Stephenson, Amy, John Vargo and Erica Seville (2010). *Measuring and comparing organisational resilience in Auckland.* *Australian Journal of Emergency Management* 25(2), pp. 27–32.

Organizations often find it difficult to demonstrate the value added by emergency management and business continuity programs, and their progress towards becoming “more resilient”. This is partly because these programs are compared to profit-driven activities for which there are metrics that can be used to evaluate whether or not they have produced financial growth. Resilience, however, focuses on social and cultural factors within organizations that contribute to the organizations’ ability to survive, and potentially even thrive, in times of crisis. The effectiveness and value of programs to build resilience are much more difficult to measure. This paper presents the initial results of a web-based survey tool developed to address this difficulty and measure and compare organizational resilience.

Infrastructure resilience

Boin, Arjen and Allan McConnell (2007). *Preparing for critical infrastructure breakdowns: The limits of crisis management and the need for resilience.* *Journal of Contingencies and Crisis Management* 15(1), pp. 50–9.

This article explores how public authorities can effectively prepare to cope with rare events in which critical infrastructure (CI) systems break down. Drawing from the literature on crisis and disaster management, they examine the strengths and weaknesses of traditional approaches to crisis preparation and crisis response. They formulate a set of strategies that enhance the resilience of a society and its critical infrastructures, and identify the strong barriers to their implementation.

Briere, Joseph (2011). *Rapid restoration of critical infrastructures: An all-hazards paradigm for fusion centres.* *International Journal of Critical Infrastructures* 7(1), pp. 21–36.

This paper takes a holistic approach to rapid restoration of critical infrastructures and key resources (CIKR) in the US. A proposal is presented to overhaul state and local fusion center guidelines to build on existing counterterrorism functions through the incorporation of compulsory all-hazards analytic capabilities with a core focus on CIKR support. In this role, fusion centers will be able to work with public and private sector partners in a unified preparation and mitigation effort, subsequently acting as force multipliers for community stakeholder-driven rapid restoration of CIKR following any type of emergency.

Croope, Silvana V. (2010). *Managing critical civil infrastructure systems: Improving resilience to disasters.* *Dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Civil Engineering.*

In this dissertation in civil engineering, the author advances a decision support system to develop critical infrastructure resilience strategies for maintaining and improving infrastructure systems and assuring continued critical infrastructure systems’ services during disasters.

Eusgeld, Irene, Cen Nan and Sven Dietz (2011). *“System-of-systems” approach for interdependent critical infrastructures.* *Reliability Engineering & System Safety* 96(6), pp. 679–86.

The study of the interdependencies within critical infrastructures (CI) is a growing field of research. New methods are required to model and describe such “systems of systems” (SoS) as a whole. A significant challenge associated with this model may be to create “what-if” scenarios for the analysis of interdependencies. This paper analyzes the interdependencies between industrial control systems (ICS), in

particular SCADA (Supervisory Control and Data Acquisition), and the underlying critical infrastructures to address the vulnerabilities related to the coupling of these systems. The modeling alternatives for systems of systems, integrated models versus coupled ones, are discussed.

Fisher, Ronald E. and Michael Norman (2010). *Developing measurement indices to enhance protection and resilience of critical infrastructure and key resources.* *Journal of Business Continuity & Emergency Planning*, 4(3), pp. 191-206.

This article describes the three indices, Protective Measures Index, Resilience Index, and Criticality Index, that are being developed as part of the Enhanced Critical Infrastructure Protection initiative of the DHS. The article covers two core themes: determination of the vulnerability, resilience, and criticality of a facility, and comparison of the indices at different facilities.

Petit, Frédéric, Michael Collins and Ronald E. Fisher (2011). *An index to analyze resilience of critical infrastructure.* In: *The CIP Report 9/8*. Arlington, VA: Center for Infrastructure Protection and Homeland Security. URL: http://cip.gmu.edu/archive/CIPHS_TheCIPReport_February2011_Resilience.pdf, archived by WebCite® at <http://www.webcitation.org/5yGD88oYf>.

This article presents the Resilience Index (RI) formulated by Argonne National Laboratory in partnership with the DHS to capture the fundamental aspects of resilience (i.e., robustness, rapid recovery, and resourcefulness) for critical infrastructures and key resources with respect to different types of threats.

Community resilience

Bohle, H.G., Benjamin Etzold and Markus Keck (2009). *Resilience as agency.* *IHDP Update 2/2009*. URL: <http://www.earthssystemgovernance.org/publication/bohle-hans-georg--resilience-agency>, archived by WebCite® at <http://www.webcitation.org/5yJ1rqXpc>.

This article re-frames resilience as a people-centered approach and highlights the importance of agency-based perspectives, analyzing the food system of Dhaka, Bangladesh, as a case study.

Coles, Eve and Philip Buckle (2004). *Developing community resilience as a foundation for effective disaster recovery.* *Australian Journal of Emergency Management* 19(4), pp. 6–15.

In this article, the authors compare the resilience of communities and the engagement of local communities in disaster recovery in Australia and the UK.

Cutter, Susan L., Christopher G. Burton and Christopher T. Emrich (2010). *Disaster resilience indicators for benchmarking baseline conditions.* *Journal of Homeland Security and Emergency Management* 7(1).

This paper provides a methodology and a set of indicators for measuring baseline characteristics of communities that foster resilience. By establishing baseline conditions, it becomes possible to monitor changes in resilience over time in particular places and to compare one place to another.

Cutter, Susan L., Lindsey Barnes, Melissa Berry, Christopher Burton, Elijah Evans, Eric Tate and Jennifer Webb (2008). *Community and regional resilience: Perspectives from hazards, disasters, and emergency management.* CARRI Research Report 1. Oak Ridge: Community and Regional Resilience Institute (CAR-RI). URL: http://www.resilientus.org/library/FINAL_CUT-TER_9-25-08_1223482309.pdf, archived by WebCite® at <http://www.webcitation.org/5yJ2OpeVy>.

This research paper outlines what makes people and places vulnerable (including location, infrastructure, and economic factors); what makes communities resilient (including recognizing and understanding hazards and planning for disaster recovery, planning and land use, and development); and barriers to planning for resilience.

Emmer, Rod, LaDon Swann, Melissa Schneider, Tracie Sempier and Tina Sanchez. *Coastal Resiliency Index: A community self-assessment – A guide to examining how prepared your community is for a disaster* (Washington, D.C.: NOAA).

URL: http://www.seagrant.noaa.gov/focus/documents/HRCC/resiliency_index_7-15-08.pdf, archived by Web-Cite® at <http://www.webcitation.org/5yJ16zJzh>.

The purpose of this self-assessment is to provide community leaders with a simple and inexpensive method of predicting whether their community will reach and maintain an acceptable level of functioning and structure after a disaster. Experienced local planners, engineers, floodplain managers, or administrators can complete this self-assessment using existing sources of information from their community

Flynn, Stephen E. (2008). *America the resilient: Defying terrorism and mitigating natural disasters*. *Foreign Affairs*, March/April 2008.

In this article, the author offers his proposal for an US response to the political threats and natural disasters facing the US in 2008. He suggests that external forces such as terrorism and natural disasters have given rise to a sense of powerlessness and a climate of fear among the US population. He warns that the result of this national mood is the undermining of US ideals, which in turn increases domestic political demagoguery. In order to combat these factors, the author suggests a return to the notion of national self-reliance, adaptability, and dynamism.

Gaillard, J.C. (2010). *Vulnerability, capacity and resilience: Perspectives for climate and development policy*. *Journal of International Development* 22(2), pp. 218–32.

In the decades since the terms “vulnerability”, “capacity”, and “resilience” became popular in both the disaster and development literatures through natural and social science discourses, the terms have been applied to many development- and disaster-related policies and have been the subject of much

debate and interpretation amongst various schools of thought. In this article, an illustrative review of the use of these terms is given, followed by a critique of the main discourses.

Gissing, Andrew, Chas Keys and Steve Opper (2010). *Towards resilience against flood risks*. *Australian Journal of Emergency Management* 25(2), pp. 39–45.

In Australia, flooding constitutes a major environmental threat, and the start of the 21st century has seen emergency services developing their flood emergency management capabilities in increasingly challenging and uncertain circumstances. This paper discusses key trends and challenges facing flood emergency management agencies in seeking to increase resilience against the flood threat and proposes some potential advances in flood emergency management. In addition, the paper explores the importance of relationships between emergency management, flood warning, and floodplain management agencies in managing future trends and challenges.

Maguire, Brigit and Patric Hagan (2007). *Disasters and communities: Understanding social resilience*. *Australian Journal of Emergency Management* 22(2), pp. 16–20.

In this paper, the authors review the multifaceted nature of social resilience, and how this capacity is thought to have various properties, notably resistance, recovery, and creativity. They also discuss the idea that social groups within a community differ in terms of their levels of resilience and the threats to which they are resilient. While research in the social sciences suggests that social resilience is a “naturally emergent” response to disaster, they argue that emergency management plans must recognize and build on this capacity, and that improved indicators of social resilience are a priority area for future research.

Manyena, Siambabala Bernard (2006). *The concept of resilience revisited*. *Disasters* 30(4), pp. 434–50.

This paper reviews the resilience concept in terms of definitional issues, the role of vulnerability in resilience discourse and its meaning, and the differences between vulnerability and resilience. It concludes with some of the more immediately apparent implications of resilience thinking for the way we view and prepare for disasters.

McCreight, Robert (2010). *Resilience as a goal and standard in emergency management*. *Journal of Homeland Security and Emergency Management* 7(1), Article 15.

This opinion article offers a perspective on the topic of resilience that contends that resilience is much more than mitigation and recovery, but combines those efforts with the investment of deliberate civic involvement.

Norris, Fran H., Susan P. Stevens, Betty Pfefferbaum, Karen F. Wyche and Rose L. Pfefferbaum (2008). *Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness*. *American Journal of Community Psychology* 41(1–2), pp. 127–50.

Drawing upon publications from several disciplines, the authors present a theory of resilience that encompasses contemporary understandings of stress, adaptation, wellness, and resource dynamics. Community resilience is a process linking a network of adaptive capacities (resources with dynamic attributes) to adaptation after a disturbance or adversity. Community resilience emerges from four primary sets of adaptive capacities: Economic development, social capital, information and communication, and community competence. Taken together, they provide a strategy for disaster readiness.

Pooley, Julie Ann, Lynne Cohen and Moira O'Connor (2010). *Bushfire communities and resilience: What can*

they tell us? *Australian Journal of Emergency Management* 25(2), pp. 33–8.

By using the experience of the community members to understand the experience of living in a bushfire-affected community, the authors extract the factors that are important to a competent, resilient community. This current study used qualitative methods to determine that five factors (sense of community, social support and social networks, self-efficacy, coping, and community competence) are important aspects of the communities experience in mediating bushfire disasters.

Simpson, David M. (2006). *Indicator issues and proposed framework for a Disaster Preparedness Index (DPI)*. Draft report to the Fritz Institute Disaster Preparedness Assessment Project. Louisville: Center for Hazards Research and Policy Development.

URL: <http://www.fritzinstitute.org/PDFs/WhitePaper/DaveSimpson%20IndicatorsRepor.pdf>, archived by WebCite® at <http://www.webcitation.org/5yJ1PPMEW>.

Based on the current state of practice, this paper examines the issues in measuring disaster preparedness, and the process of constructing indicators and indices. Existing indices are examined, and a proposed framework of creating a Disaster Preparedness Index (DPI), and Resiliency Index (Ri) with a suggested list of measurement indicators is put forward.

Twigg, J. (2007). *Characteristics of a disaster-resilient community: A guidance note*. Paper prepared for the Department for International Development (DFID) Disaster Risk Reduction Interagency Coordination Group. URL: http://www.preventionweb.net/files/2310_Characteristicsdisasterhighres.pdf, archived by WebCite® at <http://www.webcitation.org/5yJ3JALuE>.

This paper identifies some basic characteristics of community resilience that can measure the impact of national and international-level disaster risk reduction work at the community level.

Personal/Individual resilience

Clark, Irma (2011). *Personal resilience is at the core of effective continuity of operations plans*. In: The CIP Report 9/10. Arlington, VA: Center for Infrastructure Protection and Homeland Security. URL: http://cip.gmu.edu/archive/CIPHS_TheCIPReport_April2011_COOP_COG.pdf, archived by WebCite® at <http://www.webcitation.org/5yJ4Fducu>.

This article examines the important link between personal resilience and continuity of operations plans in emergency management.



The **Center for Security Studies (CSS) at ETH Zurich** specializes in research, teaching, and information services in the fields of international relations and security policy. The CSS also acts as a consultant to various political bodies and the general public. The Center is engaged in research projects with a number of Swiss and international partners, focusing on new risks, European and transatlantic security, strategy and doctrine, state failure and state building, and Swiss foreign and security policy.

The **Crisis and Risk Network (CRN)** is an Internet and workshop initiative for international dialog on national-level security risks and vulnerabilities, critical infrastructure protection (CIP) and emergency preparedness.

As a complementary service to the International Relations and Security Network (ISN), the CRN is coordinated and developed by the Center for Security Studies at the Swiss Federal Institute of Technology (ETH) Zurich, Switzerland. (www.crn.ethz.ch)