

2 Concepts of Security Threats, Challenges, Vulnerabilities and Risks

Hans Günter Brauch

2.1 Introduction¹

The reconceptualization of security has been triggered by the end of the Cold War, by the process of globalization, and by the gradual transition from the Holocene to the Anthropocene phase of earth history (Brauch 2008, 2009, chap. 1 by Brauch/Oswald Spring above). From a philosophical perspective, in the contemporary security discussion the “dual moment of prevention and compensation of genuinely social and technical uncertainties” (Makropoulos 1995: 745–750) becomes decisive. These new uncertainties are no manifest or latent dangers emerging from individuals and societal groups that can be prevented by police and political measures but ‘societal risks’. This implies that security is no longer a situation free of dangers, but rather an ‘insurance’ as a ‘technology of risks’ becomes a disposition of the social steering of modern societies. With the shift of focus from protection against concrete dangers towards insurance in the context of abstract risks, security has become “a general ‘societal idea of value’ (*Wertidee*) and a universally employed ‘normative concept’, that is used with different meanings in an affirmative manner” (Makropoulos 1995: 749).

Today ‘security’ as a political value, at least in Western thinking, has no independent meaning and is related to individual or societal value systems. As a social science concept, “security is ambiguous and elastic in its meaning” (Art 1993: 820–22). Wolfers (1962) pointed to two sides of the security concept: “Secu-

rity, in an *objective* sense, measures the absence of threats to acquired values, in a *subjective* sense, the absence of fear that such values will be attacked”. From the perspective of social constructivist approaches in international relations (Adler 1997; Fearon/Wendt 2002; Risse 2003; Wendt 1992, 1999) ‘security’ is conceived as an outcome of a process of social and political interaction where social values and norms, collective identities and cultural traditions are essential. From this perspective, security is always *intersubjective* or “security is what actors make of it” (Wendt 1992).

For Wolfers security refers to an *absence of objective dangers*, i.e. of security ‘threats’, ‘challenges’, ‘vulnerabilities’ and ‘risks’, and of *subjective fears or concerns*, and to the *perception thereof*. From a realist perspective, *objective* security is achieved when the dangers posed by manifold threats, challenges, vulnerabilities and risks are avoided, prevented, managed, coped with, mitigated and adapted to by individuals, societal groups, the state or regional or global international organizations. From a social constructivist approach, security is achieved once the perception and fears of security ‘threats’, ‘challenges’, ‘vulnerabilities’ and ‘risks’ are allayed and overcome. While objective factors in the security perception are necessary, they are not sufficient. Subjective factors influence security perceptions. The *perception* of security dangers depends on the worldviews or traditions of the analyst (Bull 1977, Wight 1991) and on the mind-set of policymakers (Booth 1979, 1987: 39–66) that have often distorted the assessment of ‘new challenges’ and that “freeze international relations into crude images, portray its processes as mechanistic responses of power and characterize other nations as stereotypes” (Booth 1987: 44; 1998: 28). Influenced by these worldviews and mind-sets, security is a concept of *s* (Buzan/Hansen 2009) and of *peace and conflict research* (Albrecht/Brauch 2008, 2009).

Since 1990 new debates have emerged between traditional approaches, critical security studies, and

1 This chapter is based on several earlier papers of the author most particularly on two reports he wrote for UNU-EHS (Brauch 2005, 2005a), several chapters he wrote for volume 39 of UNESCO’s *Encyclopaedia of Life Support Systems* (Brauch 2007, 2007a, 2007b, 2007c), as well as on a contract report he wrote for UNESCO (Brauch 2006, 2008a). The permission of these institutions to use the previous material is kindly acknowledged. The author appreciates the very useful comments of three reviewers.

constructivist approaches. While *national security* has the state as the major referent, *human security* has human beings and humankind as the referent. The answers to the questions of security for whom, from whom, by whom, of what values, from what threats and by what means differ fundamentally between both concepts.

On the background of the observed widening, deepening and sectorialization of the security concept, this chapter reviews four *objective security dangers* and *subjective security concerns* often referred to as security ‘threats’ (2.2.), ‘challenges’ (2.3), ‘vulnerabilities’ (2.4) and ‘risks’ (2.5), and the use of these basic concepts in different scientific research communities, especially those working on global environmental change, climate change, as well as hazards and disasters. It discusses the relevance of these four concepts for the ‘environmental’ security dimension (2.6) and for ‘human security’ (2.7) approaches. The goal of this chapter is to enhance synergies and to mainstream related efforts to strengthen proactive policy initiatives (2.8).

2.2 Reconceptualizing ‘Security Threats’

2.2.1 ‘Threat’ as a Political Term

The English term ‘threat’, or ‘menace’ (Latin: ‘trudere’ or to push, thrust; French: ‘menace’; Italian: ‘minaccia’; Spanish: ‘amenaza’ or ‘conminación’; Portuguese: ‘ameaça’; German: ‘Drohung’ or ‘Bedrohung’) refers to “a communication of a disagreeable alternative to an individual or group by one in authority or who pretends to be” (Koschnick 1992: 210). According to *Webster’s Dictionary* a ‘threat’ is “1. a statement or expression of intention to hurt, destroy, punish, etc. in retaliation or intimidation”, and 2. “an indication of imminent danger, harm, evil etc.; as, the threat of war” (McKechnie 1979: 1901). Langenscheidt-Longman (1995) defines ‘threat’ as: “1. a statement that you will cause someone pain, unhappiness, or trouble...; 2. the possibility that something very bad will happen (famine, attack etc.)...; 3. someone or something that is regarded as a possible danger”. For the *Compact Oxford English Dictionary* threat means: “1. a stated intention to inflict injury, damage, or other hostile action on someone; 2. a person or thing likely to cause damage or danger; 3. the possibility of trouble or danger” (Soanes 2000: 1199). For the *Shorter Oxford English Dictionary* threat refers to “1. A throng or

crowd of people; a troop, a band. ... 2. Oppression, compulsion; torment; distress, misery; danger. ... 3. A declaration of an intention to make some hostile action, esp. a declaration of an intention to inflict pain, injury, damage, or other punishment in retribution for something done or not done. ... An indication of the approach of something unwelcome or undesirable; a person or thing regarded as a likely cause of harm etc.” (Oxford ⁵2002: 3251). Thus, in the common use of the term in contemporary British and American English the word ‘threat’ has multiple meanings.

2.2.2 ‘Threat’ as a Scientific Concept

In security policy and studies ‘threat’ is used as a ‘political term’ and as a ‘scientific concept’ that remains undefined in many social science dictionaries. Robertson (1987: 304–305) used the concept ‘threat assessment’ as an analysis of “the reasons behind an opponent’s armament programmes” that was often made during the Cold War “on a worst case basis”, where “besides personnel and hardware totals” the opponent’s strategic doctrine had also to be taken into account.

During the Cold War, within the framework of *national security*, Buzan (1983: 57) pointed to a dual threat to state institutions by force (capabilities) and ideas (ideology). The state’s territory “can be threatened by seizure or damage, and the threats can come from within and outside of the state”. For Buzan different components of the state are vulnerable to different types of threats where strong states are primarily threatened by outside forces while weak states may be challenged both from within and outside. From a national security perspective, Buzan (1983: 75–83) distinguished between *military threats* (seizure of territory, invasion, occupation, change of government, manipulation of policy), *economic threats* (export practices, import restrictions, price manipulations, default on debt, currency controls etc., and those to domestic stability), and *ecological threats* (damaging the physical base of the state). These threats, Buzan (1983: 88) argued, “define [the state’s] insecurity, and set the agenda for national security as a security problem”. These threats require to understand the state’s vulnerabilities. Weapons development as a combination of capabilities and intentions has been semi-independent from threats. Dealing with specific threats, an international security strategy focuses on “the sources and causes of threats, the purpose being not to block or offset the threats, but to reduce

or eliminate them by political action” (Buzan 1983: 218).

This type of ‘threat’ has disappeared in Europe with the end of the East-West conflict in 1990, and thus the threat perception has fundamentally changed. Already during the first (1969–1975) and second détente (1986–1989) the classic threat concept lost in importance. Since 1990, threat is also defined as referring to the dangers the planet earth is confronted with due to the manifold destructive potentials of the environment and its global and societal consequences. Steiner (2001) pointed to the fundamental change in the risks, dangers and threats since 1990, which has increased the dangers of violent domestic wars and has reduced the effectiveness of arms control regimes. But outside Europe, e.g. in the Middle East, in South Asia or on the Korean Peninsula, many of the old threats have not been overcome.

However, the increase in asymmetric forms of warfare (Kaldor 1999; Kaldor/Vashee 1997; Münkler 2002, 2005), and of the increasing role of more sophisticated and brutal non-state actors (or terrorist networks) but also the negative global impacts of uncontrolled financial activities (by greedy speculators and hedge funds as a kind of ‘structural terrorism’² with non-violent means provoking new forms of personal and structural violence) have made the security dangers more complex and the security risks less calculable and predictable.

2.2.3 Redefining the Concept of ‘Threat’ to Security since 1990

Two decades after the end of the Cold War, Buzan and Hansen (2009: 11–12) referred to four key questions that structure *international security studies* (ISS) focusing on the state as the key referent object, on including internal and external threats that have been increasingly blurred by globalization, on the widening beyond the military dimension and the use of force and its close link to “a dynamic of threats, dangers and urgency”. While during the Cold War a majority of ISS focused on external threats, since its end “ethnic conflict and civil wars came to the fore, so did questions of domestic stability and cohesion (Posen 1993; Van Evera 1994; Kaufmann 1996)” (Buzan/Hansen 2009: 29) that were discussed in the concept of ‘societal security’ introduced by the Copenhagen School (Wæver/Buzan/Kelstrup/Lemaitre 2003; Buzan/Wæver/de Wilde 1998; Wæver 2008a).

The threat concept as the basis for military planning and legitimating military programmes – at least among many NATO countries – has fundamentally changed after 1990. With the widening of the security concept from the traditional military and diplomatic security, to the new economic, societal and environmental dimensions, the threat concept has also widened and been applied to a series of new threats not only to the ‘state’ but also to the other referents of new security concepts, from human beings to global security.

The early proponents of environmental security have extended ‘threats’ from the military to the environmental realm. Ullman (1983: 133) defined a national security *threat* as “an action or sequence of events that: 1) threatens drastically and over a relatively brief span of time to degrade the quality of life for the inhabitants of a state; or 2) threatens significantly to narrow the range of policy choices available to the government of a state or to private non-governmental entities (persons, groups, corporations) within the state”. For Mathews (1989) and Myers (1989, 1989a) the *new security threats* of the future included population growth, resource scarcity, and environmental degradation.

The Brundtland Commission (1987) also referred to two great threats facing humankind: “The first is that of nuclear exchange. ... The second is that of environmental ruin worldwide”. In 1988 President Gorbachev stressed: “The relationship between man and the environment has become menacing. ... The threat from the sky is no longer missiles but global warm-

2 The term ‘structural terrorism’ has been inspired by Galtung’s (1969, 1975) differentiation between personal and structural violence. This term has been used by Kapitan (2004) for states: “States, in particular, accomplish such *structural terrorism* by forcibly implementing or impeding institutions, laws, policies, and practices that result in harm to noncombatants.” F.H. Knelman: “Who Are the Terrorists” (October 2001), in: Nuclear Peace Foundation; at: <http://www.wagingpeace.org/articles/2001/10/00_knelman_who.htm> (16 May 2010) referred to “internal or structural terrorism derived from poverty, disease, murder, hunger and deprivation of all kinds”. The term ‘structural terrorism’ is used here in a different meaning by pointing to non-state economic actors and processes that have contributed to the worst global financial crisis since 1929 and that have added with speculation on food commodities to price hikes in basic food staples and the resulting food riots causing many casualties from protests and more who died of hunger.

ing". Brundtland (1993: 189–194) pointed to the new ‘threats’ to security that “may be caused by social unrest caused by poverty and inequality, by environmental degradation, by internal conflicts leading to new flows of refugees”. She noted that “the pressure on the environment from a rapidly growing world population will increase the likelihood of such conflicts. Climate change, desertification, deforestation, massive loss of species and biological diversity, depletion of freshwater resources and soil erosion are global trends that are not sustainable”. As most serious she saw “the threats to the world’s atmosphere”.

In 1992, Senator Al Gore referred to several environmental threats from the local (tactical) to the global (strategic) level such as global warming and ozone depletion. In 1997, Eilen Claussen defined as global environmental threats those “which are human-caused and have, or can be expected to have serious economic, health, environmental, and quality of life implications for the United States”. Irrespective of the application of this concept to environmental problems, this author suggested to limit the threat concept to hardware related military problems, and to describe dangers posed by the environment as “environmental security challenges, vulnerabilities and risks” (Brauch 2005a, 2008a). However, in political practice, e.g. in the US national security strategy papers (see chap. 12 by Brauch below); this suggestion could not be observed.

2.2.4 Application of a Widened Concept of Security Threats

Several countries reacted in their national defence white papers and national strategic documents to the fundamental change in the nature of threats with an extended security concept that included many new non-military soft security threats such as: economic vulnerabilities, environmental challenges, political and societal instabilities (e.g. German Defence White Paper; BMVg 1994: 25–26) pointing to a “multitude of risk factors of a different nature with widely varying regional manifestations”. The official German document suggested that “risk analysis of future developments must be based on a broad concept of security ... They must include social economic and ecological trends and view them in relation to the security of Germany and its allies.”³

In the United States, several national security strategy papers of the Clinton administration have pointed to the fundamental change in security threats (Matthew/Mc Donald 2009). The administration of

George W. Bush in its *Quadrennial Defense Review Report* (QDR) of 30 September 2001 announced: “to shift the basis of defence planning from a ‘threat-based’ model that has dominated thinking in the past to a ‘capabilities-based’ model in the future [that] ... focuses more on how an adversary might fight rather than specifically who the adversary might be or where a war might occur” (Brauch 2003b, chap. 12 by Brauch). The first QDR of the Obama Administration of 1 February 2010 referred to “Climate change and energy [as] two key issues ... in shaping the future security environment”. It further acknowledged that

climate change could have significant geopolitical impacts around the world, contributing to poverty, environmental degradation, and the further weakening of fragile governments. Climate change will contribute to food and water scarcity, will increase the spread of disease, and may spur or exacerbate mass migration. While climate change alone does not cause conflict, it may act as an accelerant of instability or conflict, placing a burden to respond on civilian institutions and militaries around the world. In addition, extreme weather events may lead to increased demands for defense support to civil authorities for humanitarian assistance or disaster response both within the United States and overseas. ... DoD has undertaken environmental security cooperative initiatives with foreign militaries that represent a nonthreatening way of building trust, sharing best practices on installations management and operations, and developing response capacity (DoD 2010: 85).

The Pentagon now considers climate change as a “legitimate national security concern” (Parthermore/Rogers 2010), even though not yet specifically as a ‘national security threat’. This is also reflected in the first *National Security Strategy* of the Obama Administration (chap. 12 by Brauch).

The guarantee of “international peace and international security” was emphasized in the Covenant of the League of Nations (28 April 1919) and in the United Nations Charter (26 June 1945) “to maintain international peace and security”. But in 1919 and in 1945, “development” and “environment” were not yet political concepts.

3 The most recent German Defence White Paper refers to new opportunities as well as risks and threats posed by globalization and it notes among the strategic framework conditions “global challenges, opportunities, risks and dangers” (BMVg 2006: 20–23) and lists among them: globalization, terrorism, proliferation and armament tendencies, regional conflicts, illegal arms trade, impediments for development and fragile statehood, transportation routes, resources, communication, energy security, migration and pandemics.

The UN Charter distinguished among three security systems: a universal system of *collective security* (Chap. VI: Art. 33–38; Chap. VII: Art. 39–50); “*regional arrangements or agencies*” (Chap. VIII: Art. 52 to 54); and a right of “*individual or collective self-defence*” (WEU, NATO; WTO) in Art. 51. While the first two systems deal with “threats to peace and international security” from within, among member states, the third is oriented against an outside threat. They perform three functions: peaceful settlement of disputes, peace enforcement and peacekeeping. Art. 1.1 of the UN Charter calls on its members “to take effective collective measures for the prevention and removal of threats to the peace, and for the suppression of acts of aggression or other breaches of the peace”, “to develop friendly relations among nations” and “to achieve international co-operation in solving international problems of an economic, social, cultural, or humanitarian nature”. The UN Charter relies on a narrow ‘nation’-centred concept of ‘international security’ and on a concept of ‘negative peace’, although Art. 1.1, 1.2, and Art. 1.3 “indicate that peace is more than the absence of war” (Wolfrum 1994: 50).

During the Cold War, collective self-defence prevailed while collective security was paralysed (Brauch/Mesjasz/Møller 1998). After 1990, collective security was temporarily strengthened, but with the failure to solve the Gulf War (1990–1991) and to cope with the post-Yugoslav conflicts (1991–1999) within the framework of the UN, NATO and the EU emerged as key security institutions. Since 1990 the UN Security Council decisions on humanitarian interventions and the debate on ‘environmental’ and ‘human’ security have moved beyond these constraints and also the meaning of peace and security has significantly changed (Bothe 2008).

The Report of the Secretary-General’s High-level Panel on Threats, Challenges and Change (2 December 2004) reflects this widening of the ‘security’ concept pointing to new tasks for the UN system in the 21st century. In the new emerging security consensus, collective security rests on three basic pillars (Synopsis of the Report):

Today’s threats recognize no national boundaries, are connected, and must be addressed at the global and regional as well as the national levels. No State, no matter how powerful, can by its own efforts alone make itself invulnerable to today’s threats. And it cannot be assumed that every State will always be able, or willing, to meet its responsibility to protect its own peoples and not to harm its neighbours. ... Differences of power, wealth and geography do determine what we perceive as the gravest threats to our survival and well-being. ...

Without mutual recognition of threats there can be no collective security. ... What is needed is nothing less than a new consensus. ... The essence of that consensus is simple: we all share responsibility for each other’s security.⁴

The High-level Panel distinguished among six clusters of threats, ranging from economic and social threats (including poverty, infectious disease and *environmental degradation*, interstate and internal conflict, weapons of mass destruction, terrorism and transnational organized crime. Thus, for the first time “environmental degradation” is listed among the threats confronting the UN that require preventive action “which addresses all these threats”. Development “helps combat the poverty, infectious disease and environmental degradation that kill millions and threaten human security”. The High-level Panel (§ 53) claims:

Environmental degradation has enhanced the destructive potential of natural disasters and in some cases hastened their occurrence. The dramatic increase in major disasters witnessed in the last 50 years provides worrying evidence of this trend. More than two billion people were affected by such disasters in the last decade, and in the same period, the economic toll surpassed that of the previous four decades combined. If climate change produces more flooding, heat waves, droughts and storms, this pace may accelerate.

The High-level Panel notes that “rarely are environmental concerns factored into security, development or humanitarian strategies” and it points to the lack of effective governance structures to deal with climate change, deforestation and desertification, as well as to the inadequate “implementation and enforcement” of regional and global treaties. In the discussion of the legitimacy of the use of military force, the High-level Panel distinguishes between “harm to state or human security”. Two of the 101 recommendations of the High-level Panel deal with environmental issues, with renewable energy sources and with the Kyoto Protocol. The High-level Panel mentioned ‘human security’ several times, but its main focus remained on the ‘state’ as the cause and as a key actor in dealing primarily with military and societal threats.⁵

4 See for download of the complete report and press releases at: <<http://www.un.org/secureworld/>>.

5 For an assessment of the High-level Panel see von Einsiedel, Nitzschke and Chhabra (2008); on the ‘security development’ nexus see Sending (2008), Katseli (2008), Klingebiel and Roehder (2008) and most recently see Tschirgi, Lund and Mancini (2010).

On 21 March 2005, in his own report: “*In larger freedom: towards development, security and human rights for all*”, Kofi Annan (2005) drew both on the High-level panel and on the assessment of the *Millennium project*. He analysed the three key goals of development as ‘freedom from want’, of security as ‘freedom from fear’, and human rights as ‘freedom to live in dignity’. With regard to security, Annan (2005: 24) noted a lack of consensus on the assessment of the threat. He has listed among the present threats to peace and security:

international war and conflict ..., civil violence, organized crime, terrorism and weapons of mass destruction. They also include poverty, deadly infectious disease and environmental degradation since these can have equally catastrophic consequences. All of these threats can cause death or lessen life chances on a large scale. All of them can undermine States as the basic unit of the international system. ... In our globalized world, the threats we face are interconnected. The rich are vulnerable to the threats that attack the poor and the strong are vulnerable to the weak, as well as vice versa. A nuclear terrorist attack on the United States or Europe would have devastating effects on the whole world.

Following his High-level Panel, Annan discussed four threats in detail: a) preventing catastrophic terrorism; b) organized crime; c) nuclear, biological and chemical weapons; and d) reducing the risk and prevalence of war.

The *European Union Security Strategy* (European Council 2003) also referred to five key threats: “terrorism, weapons of mass destruction, regional conflicts, state failure, and organized crime”. But this strategy also pointed to new global challenges and vulnerabilities confronting the European Union. Since 2007, both the UN and the EU have repeatedly stated that climate change poses new threats to international security (chap. 1 by Brauch/Oswald Spring).

2.3 Reconceptualizing ‘Security Challenges’

2.3.1 The Political Term of ‘Challenges’ for Security

For ‘challenge’ (Lat.: ‘calumnia’, false accusation; Fr.: ‘defi’; Sp.: ‘desafío’, ‘reto’; Port.: ‘desafio’; It.: ‘sfida’; Ger.: ‘Herausforderung’) the synonyms are “confrontation, defiance, interrogation, provocation, question, summons to contest, test, trial, ultimatum”, as well as “questioning, dispute, stand opposition; difficult task, test trial”. *British English* dictionaries offered these

meanings of the term challenge: “1. something difficult ... that tests strength, skill, or ability...; 2. questioning rightness: a refusal to accept that something is right and legal; 3. invitation to compete: a suggestion to someone that they should try to defeat you in a fight, game etc.; 4. a demand to stop: a demand from someone such as a guard to stop and give proof who you are, and an explanation of what you are doing”; or: “a demanding task or situation”; as well as: “call to try one’s skill or strength; demand to respond or identify oneself; formal objection”; or: “a call to engage in a fight, argument or contest; a questioning of a statement or fact; a demanding or stimulating situation, career, etc.”

2.3.2 The Political and Scientific Concept of ‘Security Challenges’

The term ‘challenge’ has often been used for security and global issues but it has hardly been defined, and in many cases it is used synonymously with ‘threat’ (chap. 12 by Brauch).⁶ Dodds and Schnabel (2001: 42–43) pointed to ‘new’ and ‘non-traditional’ security challenges as a major concern in the post-cold war security environment. They argued “that the general public’s conception of the security environment has altered so dramatically as we enter the new millennium is an indicator of how significantly this environment may have actually changed”. They see as major forces for the reconceptualization of security “the increasing level of globalization” that “has engendered a growing sense of vulnerability to ... remote threats, such as distant conflicts, contagions, crop failures and currency fluctuations”.

2.3.3 Application of the Concept of ‘Security Challenges’

Van Ginkel and Velásquez (2001: 58–70) pointed to these environmental challenges: a) ozone depletion; b) impact of toxic chemicals on the global ecosystem; and c) increasing greenhouse emissions and their negative reinforcements as well as to “uncertainty about

6 *Security Challenges* is the name of Australia’s leading peer-reviewed journal on future security issues that “reaches a wide audience of established military, government, commercial and academic experts as well as up-and-coming younger players in the security field” that aims for “innovative thinking about future challenges to the security (broadly defined) of Australia and other countries in the Asia Pacific region. See at: <<http://www.securitychallenges.org.au/index.html>>.

the future and an element of surprise”, especially if associated with natural and man-made environmental disasters. They stressed eight sub-themes: “global environmental governance, water, urbanization, industry and sustainability, global food security, energy requirements for the next millennium, global governance of biological diversity, land degradation, and the atmosphere”.

In a report of the Trilateral Commission, Slaughter, Bildt and Ogura (2004) tried “to integrate traditional understandings of state security ... with an appreciation of the magnitude and importance of ‘global security issues’: terrorism, environmental degradation, international crime, infectious diseases and refugees”. They organized the many ideas and proposals in five basic dichotomies: “State security versus human security; hard versus soft interventions; legality versus legitimacy; pre-emption versus prevention; and states versus non-state actors” (Slaughter 2004).

The former director of the Stockholm International Peace Research Institute (SIPRI), Amb. Alyson J.K. Bailes (2003; also chap. 6 below), in a talk on “New Security Challenges for the EU” noted several human security challenges confronting Europe: “such as the collapse of the environment, pollution of food and natural resources, human and animal disease and genetic manipulation, employment, health care and social security in general”. These are not just subjective but also scientific perceptions. She referred to many non-military, non-intentional threats, such as:

greenhouse effect, depletion of ozone, badly-handled migration, ageing of the population, and an energy crisis as well as the ... case of a nuclear accident. ...The lesson is that many aspects of life in the EU which do fall within the Union’s competence but are not normally thought of as security matters are indeed highly relevant to the survival and welfare of our populations, and the more so precisely because of the high level of development and interdependence we have attained. The ... harmonized approaches ... should ... be extended ... to deal e.g. with climatic damage (drought, heat, storm and flood), major cases of pollution, and the interruption of any type of energy supplies.

This comprehensive list of security challenges for the EU in the post-Cold War period indicates a basic shift since 1990 away from primarily military threats from the rival superpower to a broad range of manifold challenges from all dimensions of a widened security concept. Security challenges may refer to less urgent and sometimes non-violent *soft security* problems, such as migration, human and drug trafficking. These issues are less on the external and primarily on the internal security agenda, and thus a topic for the home

and justice ministries and agencies, such as national and international police organizations and of the courts but also of non-governmental societal groups. Migration may be a consequence of domestic conflicts emerging from environmental degradation and resource depletion but it will remain difficult to distinguish *push* and *pull* factors.

2.4 Reconceptualizing ‘Security Vulnerabilities’

While the concepts of threats and challenges are often used synonymously for hard and soft security dangers, the vulnerability concept has been utilized more widely by many different policy and scientific communities with different meanings.

2.4.1 The Political and Societal Term of ‘Vulnerability’

English dictionaries refer to these synonyms ‘vulnerability’ (Lat.: ‘vulnus’ or: ‘vulnerabilis’; Fr.: ‘vulnérabilité’; It.: ‘vulnerabile’; Sp.: ‘vulnerabilidad’; Port.: ‘vulnerável’; Ger.: ‘Verwundbarkeit’) or ‘vulnerable’ as: “accessible, assailable, defenceless, exposed, open to attack, sensitive, susceptible, tender, thin-skinned, unprotected, weak, wide open”; and: “1. in danger: in peril, in jeopardy, at risk, endangered, unsafe, unprotected, unguarded; wide open; undefended, unfortified, unarmed, helpless, pregnable; 2. exposed to: open to, liable to, prone to, prey to, susceptible to, subject to, an easy target for; as well as: “non-immunity, susceptibility, danger of, insecurity, exposure, nakedness, helplessness”.

According to *Webster’s* ‘vulnerability’ is “the state or property of being vulnerable” where vulnerable refers to: “1. capable of being wounded or physically injured...; 2. open to criticism or attack...; 3. open to attack or assault by armed forces. ...; 4. in contract bridge, liable to increase penalties and entitled to increased bonuses”; or “the quality or state of being vulnerable”. *British* dictionaries offer additional meanings: “someone who is vulnerable is easily harmed or hurt emotionally, or morally”; “susceptible to injury, exposed to damage by weapon, criticism, etc.”; as well as: “open to temptation, censure etc.”; as “unprotected against attack; liable to be hurt or damaged”.

2.4.2 Vulnerability as a Scientific Concept

The vulnerability concept is defined in encyclopaedias in the geosciences where the referent object of 'vulnerability' are both human beings, especially children, and the environment. The vulnerability concept is used in the global change literature (Steffen/Sander-son/Tyson/Jäger/Matson/Moore III/Oldfield/Richardson/Schellnhuber/Turner/Wasson 2004), on climate change impacts (IPCC 2001a, 2007a) and in the disaster community (ISDR 2004). Vulnerability results from "poverty, exclusion, marginalization and inequities in material consumption", and it is generated by "social, economic and political processes" (Barnett 2001: 132-133). In the context of the precautionary principle O'Riordan (2002: 369) defined vulnerability at the societal level as: "the incapacity to avoid danger, or to be uninformed of impending threat, or to be so politically powerless and poor as to be forced to live in conditions of danger".

For Oliver-Smith (2004: 10) "vulnerability is fundamentally a political ecological concept". As a theoretical framework "vulnerability can become a key concept in translating that multi-disciplinarity into the concrete circumstances of life that account for a disaster". He argues that disasters "are channelled and distributed in the form of risk within society to political, social and economic practices and institutions". Wilches-Chaux (1989: 20-41, 1993) identified 11 types of vulnerability, "natural, physical, economic, social, political, technical, ideological, cultural, educational, ecological and institutional vulnerability". For Oliver-Smith (2004: 11) "vulnerability is conceptually located at the interaction of nature and culture" that also links "social and economic structures, cultural norms and values and environmental hazards". He discussed four questions: 1) the "general contributions of the cultural construction of nature to the social production of disaster"; 2) "how the political and economic forms and conditions that characterize vulnerability are inscribed in an environment"; 3) "the relationship between cultural interpretation and the material world of risk, threat and impact of disasters"; and 4) "how do we theorize the linkages among these three issues, particularly in the context of current patterns of globalization". Nathan (2009: 1125) pointed to a dual vulnerability:

on the one side ... a tendency to undergo damages, i.e. a state of fragility, or a set of conditions, that raise the susceptibility of a community to the impact of a damaging phenomenon. On the other side, vulnerability is an incapacity to anticipate, cope with, resist to, adapt to and recover from hazards. Vulnerable units are either

not resistant, i.e. not capable to withstand the shock (without adapting); and/or not resilient, i.e. not capable to absorb the shock and adapt to come back to an acceptable state.

Nathan (2009: 1125) characterized vulnerability "as a *complex* process encompassing multiple intricate dimensions" that is constantly changing. In his view vulnerability is:

often *cumulative*, causing disasters that in turn aggravate it, or adding to vulnerabilities to other risks (such as socio-economical risks, etc.). Furthermore, vulnerability is both *hazard-related* ... and *subject-related*. ... Therefore, one has to specify which vulnerability one is talking about, and at which level of analysis (individual, group, society). ... Vulnerability is also highly *differentiated*: different subjects, even at the same 'level', have different vulnerabilities. ... Generally, the most miserable and isolated suffer most, as well as the less organized. ... Vulnerability is *context-dependent*, be it an individual exposed to natural hazards at the household level, or mankind at a global level. These 'transversal' features of global vulnerability apply to each component of vulnerability (Nathan 2009: 1125).

Nathan (2009: 1126) distinguished among two features of vulnerability: *exposure* and *insufficient capacities*.

a) *physical exposure*: presence and density of the people, habitat, networks, goods and services in risk zones, defining potential losses or damages, both human and non-human (stakes); and b) *socio-ecological*: human-induced ecosystemic perturbations aggravating the natural hazard - such as deforestation, land degradation, street pavement, some engineering practices, climate change, etc.

Furthermore, he pointed to "insufficient capacities to prevent, prepare for, face and cope with hazards and disasters" he separated as:

- *physical weakness*: physical incapacity to resist or recover from a hazard's impact;
- *legal vulnerability*: weak state of the legislative and judiciary regulations to prevent, mitigate, prepare for, face and recover from disasters;
- *organizational vulnerability*: weak state of the organizational disposals, at all levels, to prevent, mitigate, prepare for, face and recover from disasters;
- *technical vulnerability*: inadequate knowledge and/or use of risk management techniques;
- *political vulnerability*: weakness of the political powers, their legitimacy and control. Inadequacy of the control schemes, policies and planning, or broad political conditions;

- *socio-economical vulnerability*: socio-spatial segregation, large inequalities of wealth and of access to the security disposals, misery, anomie and social disorganization, poor social position and social isolation of exposed people, existence of higher social risks undergone by people;
- *psychological and cultural vulnerability*: inadequate security paradigm or risk perceptions; cultural anomie or weakness; attachment to risk zones or risky behaviour, non-willingness or incapacity to protect oneself (Nathan 2009: 1126).

Nathan (2009: 1126; see chap. 30 below) concluded that “the overall vulnerability of an element (or stake) to one or several hazards is a mix of these particular vulnerabilities”.

Cardona (2004: 37–51; see also chap. 3 below) proposed to rethink vulnerability and risk from a holistic perspective arguing that in developing countries often social, economical, cultural and educational aspects are “the cause of the potential physical damage”. For Cardona “vulnerability of human settlements is intrinsically tied to different social processes. It is related to fragility, susceptibility or lack of resilience of the exposed elements. On the other hand, vulnerability is closely linked to natural and human environmental degradation at urban and rural levels”. Cardona (2004: 49) argued that from a social view “vulnerability signifies a lack or a deficiency of development” that often contribute to “disaster vulnerability”. He pointed out that population growth, rapid urbanization, environmental degradation, global warming, international financial pressures and war have all increased vulnerability. Cardona argued that vulnerability originates in:

- *Physical fragility* or *exposure*: the susceptibility of a human settlement to be affected by a dangerous phenomenon due to its location in the area of influence of the phenomenon and a lack of physical resistance;
- *Socio-economic fragility*; the predisposition to suffer harm from the levels of marginality and social segregation of human settlements, and the disadvantageous conditions and relative weakness related to social and economic factors; and
- *Lack of resilience*: an expression of the limitations of access and mobilization of the resources of human settlement, and its incapacity to respond when it comes to absorbing the impact.

He pointed to the closely interrelated nature of efforts reducing hazard or vulnerability, thus con-

tributing to risk reduction, and the possibility of future disaster (chap. 3 by Cardona).

According to Heijmans (2004: 115–127) disaster agencies have often focused on physical and economic vulnerability. Based on the literature she distinguished three strategies to address vulnerability:

1. *Nature as cause* → technological, scientific solutions: Reduce vulnerability by early warning systems, technologies to withstand negative impacts (monitor seismic activity, weather forecasting, remote sensing for drought, fire, water control systems, building codes, etc.).
2. *Cost as cause* → economic and financial solutions: Costly prediction and mitigation technologies; reduction of vulnerability by national safety nets, insurance and calamity funds.
3. *Social structure as cause* → political solutions: Socio-economic factors that generate vulnerability, require political and development solutions that transform the social and political structures breeding poverty.

Heijmans (2004: 117ff.) discussed the conceptual relationship between vulnerability and empowerment, argued that the people’s perspectives are missing in all three strategies, and also in the perception of vulnerability by the aid agencies. According to Wisner (2004: 183–193) vulnerability is used in the hazard community as:

- Structural engineering vulnerability;
- Lifeline infrastructural vulnerability;
- Communications systems vulnerability;
- Macro-economic vulnerability;
- Regional economic vulnerability;
- Commercial vulnerability; and
- Social vulnerability.

Wisner distinguished four approaches on social vulnerability: a) demographic; b) taxonomic; c) situational; and d) contextual or proactive approach. He criticized that many studies on social vulnerability have devalued local knowledge and coping capacities and he supported efforts to empower people to reclaim their local knowledge (chap. 52 by Laureano). Frerks and Bender (2004: 194–205) argued that the societal focus on vulnerability has shifted from disasters as a natural event to exposure and a complex socially constructed process.

Pelling (2003: 5; also in chap. 29) analysed the vulnerability of cities to natural disasters and the role of social resilience. He defined vulnerability as “exposure to risks and an inability to avoid or absorb poten-

tial harm”, *physical* vulnerability as that “in the built environment”, *social* vulnerability as that “experienced by people and their social, economic and political systems”, and *human* vulnerability as the combination of “physical and social vulnerability”.

The ‘vulnerability’ concept has been widely used, often with different meanings, by the global change research (2.4.3), by the climate change (2.4.4), by the natural hazard (2.4.5) and by the environment, development and early warning community (2.4.6), while the concept of ‘social vulnerability’ is intensively employed both in the hazard and development research and policy communities (2.4.7). The ‘vulnerability’ concept was also widely used in the security and strategic community (2.4.8) while the concepts of ‘economic’ (Crawford 1992, 1993, 1995) and ‘financial’ vulnerability have become crucial research and policy objects for the economic and policy communities (see chap. 5 and 6 by Czeslaw and Lidia Mesjasz).

2.4.3 Vulnerability as a Scientific Concept in the Global Change Research Community

Steffen, Sanderson, Tyson, Jäger, Matson, Moore III, Oldfield, Richardson, Schellnhuber, Turner and Wasson (2004) address the consequences of changes in the Earth System due to human activities for human well-being. The vulnerability concept offers a useful framework for the study of consequences of global change on human societies. Using a scenario-driven approach they discuss linear projections and non-linear surprises resulting from an integrated assessment approach: “Scenario-driven approaches to impact assessment, even the most sophisticated of the integrated assessment methods, do not allow the vulnerability or resilience of the impacted systems to be assessed directly” (Steffen/Sanderson/Tyson/Jäger/Matson/Moore III/Oldfield/Richardson/Schellnhuber/Turner/Wasson 2004: 204).

While impact assessment selects one specific environmental stress and seeks to identify the most important consequences for social and ecosystem properties on environmental stress, vulnerability assessment tries to assess the risk of diverse outcomes for a unit of concern (e.g. landless farmers) “in the face of a variety of stresses and identifies a range of factors that may reduce response capacity and adaptation to stressors” (Steffen/Sanderson/Tyson/Jäger/Matson/Moore III/Oldfield/Richardson/Schellnhuber/Turner/Wasson 2004: 205). While impact assessment offers little guidance among the many environmental stresses,

vulnerability assessment offers a maturing strategy to provide such guidance. Vulnerability to global environmental change has been conceptualized as the risk of adverse outcomes to receptors or exposure units (human groups, ecosystems and communities) in the face of relevant changes in climate, other environmental variables, and social conditions. ... Vulnerability is emerging as a multi-dimensional concept involving at least *exposure* – the degree to which a human group or ecosystem comes into contact with particular stresses; *sensitivity* – the degree to which an exposure unit is affected by exposure to any set of stresses; and *resilience* – the ability of the exposure unit to resist or recover from the damage associated with the convergence of multiple stresses. ... Vulnerability can increase through cumulative events or when multiple stresses weaken the ability of a human group or ecosystem to buffer itself against future adverse events, often through the reduction in coping resources and adaptive capacities (Steffen/Sanderson/Tyson/Jäger/Matson/Moore III/Oldfield/Richardson/Schellnhuber/Turner/Wasson 2004: 205).

Steffen et al. (2004) point to the scale- and space-dependent property of systems and thus differ on the local, regional and global level. Complex vulnerability analyses can address “multiple causes of critical outcomes rather than only the multiple outcomes of a single event”. Thus, scenario development becomes a crucial element of vulnerability analysis. An important precondition for the quantification of vulnerability parameters could be vulnerability indicators. Along these lines, Comfort, Wisner, Cutter, Pulwarty, Hewitt, Oliver-Smith, Wiener, Fordham, Peacock and Krimgold (1999) developed a “standardized all-hazards vulnerability index”. Others have suggested an Index of Human Insecurity (Lonergan/Gustavson/Carter 2000). Steffen et al. (2004: 209) admit that the current status of vulnerability research and assessment “exhibit both a potential for substantial synergy in addressing global environmental risks ... as well as significant weaknesses which undermine the potential”. A major driver of GEC has been climate change where the ‘vulnerability’ concept has been extensively discussed.

Brklacich, Chazan and Bohle (2010: 36–37) developed “a conceptual framework for understanding human vulnerability to GEC and other stressors” by combining existing frameworks into a “comprehensive human vulnerability-security model”. While human vulnerability has been extensively researched (Burton/Kates/White 1993; Mitchell 1989, 1990; Emel/Peer 1989; Watts/Bohle 1993; Adger 1999) they proposed to move “from a state of human vulnerability to one of human security” (Bohle 2001; Twigg/

Bhatt 1998; O'Brien/Vogel 2004). Earlier Bohle (2001) had pointed to the "double structure of vulnerability" linking external or environmental with internal or social vulnerability. While the external side (structure) of vulnerability refers to exposure to social and environmental stressors, the internal side (agency) points to the policy response or the capacity to mitigate, cope with, recover from, and adapt to stressors with the goal to achieve human security. While the 'structure' is influenced by the ecological and geographic context, the 'agency' depends on the institutional context and both rely on the distribution of rights and resources as well as on the control over and access to assets. For the analysis of the linkages between human vulnerability and security they suggest research on four interrelated drivers "control of and access to assets, institutional factors, distribution of rights and resources, and ecological and geographic conditions" (Brklacich/Chazan/Bohle 2010: 42). These drivers are influenced by *environmental change* (change in type, frequency, and scale of environmental threats) and by *societal change* (change in economic, political, social and demographic conditions). They concluded arguing that

Movement along the continuum from vulnerability to security is most likely influenced by context-specific, local interactions between multi-scale stressors, exposure to threats, capacity for response, and socio-environmental drivers. This contextual nature of vulnerability supports trends towards micro-level approaches to vulnerability assessment (Brklacich/Chazan/Bohle 2010: 49).

In analysing the linkages between environmental change and violent conflict, Barnett and Adger (2010: 120) listed among the factors affecting violent conflicts besides poverty, migration, and weak states also 'vulnerable livelihoods' that directly influence water, agricultural productivity, the frequency and intensity of extreme events and the distribution of diseases. "These affect livelihoods by exposing people to risks, thereby increasing their vulnerability. The impacts are more significant in sectors of the population with high resource-dependency, and located in more environmentally and socially marginalized areas."

Barnett, Matthew and O'Brien (2010a: 308ff.) pointed to several areas of future research on GEC, vulnerability and human security, such as 1) social causes of vulnerability (including gender differentiations) to environmental change; 2) the mediating role of perceptions between GEC and policy responses and the roles of values, beliefs and worldviews, 3) the interface of GEC and human health, 4) shift to peace-

ful responses to the linkage of GEC and human security (e.g. environmental peacemaking), 5) the impacts of violent conflict on human security and vulnerability to environmental change, 6) need for more consideration to linkages among human rights, human security and GEC, and 7) to reflect on the coping capabilities and resilience of the affected people.

2.4.4 Vulnerability as a Political and Scientific Concept in the Climate Research Community

Climate change impacts, adaptation and *vulnerability* have been analysed by the second IPCC working group (1990, 1996a, 2001a, 2007a) whose mandate is "to assess the vulnerability of ecological systems, socio-economic sectors, and human health to climate change". The IPCC also distinguishes between *sensitivity*, *adaptive capacity* and *vulnerability* ("the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes").

In *The Regional Impacts of Climate Change: An Assessment of Vulnerability*, the IPCC (1998) explores potential consequences of climate change for ten regions based on "assessing sensitivities and vulnerabilities of each region, rather than attempting to provide quantitative predictions of the impacts of climate change", i.e. to assess "the extent to which climate change may damage or harm a system" taking into account the sensitivity of the region to climate and the adaptive ability. The report tries to explain: "how projected changes in climate could interact with other environmental changes (e.g. biodiversity loss, land degradation, stratospheric ozone depletion, and degradation of water resources) and social trends (e.g. population growth, economic development and technological progress" (IPCC 1998: ix). It calls for more research on "interlinkages among environmental issues". This IPCC report assessed the vulnerability of natural and social systems of major regions to climate change with qualitative methods. These regional assessments focus on: a) ecosystems, b) hydrology and water resources, c) food and fibre production, d) coastal systems, human settlements, human health, and other sectors or systems including the climate system of relevance for the 10 regions analysed.

In the *Third Assessment Report* (TAR), the WG II examines "climate change impacts, adaptations and vulnerabilities of systems and regions" with the goal "to provide a global synthesis of cross-system and cross-regional issues", and "in the context of sustaina-

ble development and equity” (IPCC 2001a: 22–25). In its regional assessment, the IPCC (1998) explores potential consequences of climate change by “assessing sensitivities and vulnerabilities of each region, rather than attempting to provide quantitative predictions of the impacts of climate change”. The IPCC cautions: “The estimates ... serve as indicators of sensitivities and possible vulnerabilities” (IPCC 1998: 4). The report suggests an “anticipatory adaptation in the context of current policies and conditions” and so-called “win-win” or “no-regrets” options by adding that: “adaptation will require anticipation and planning. ... Additional analysis of current vulnerability to today’s climate fluctuations and existing coping mechanisms is needed.” As has been argued, the vulnerability concepts in the GEC and in the climate change communities have differed significantly from those concepts that have been employed in the hazard research community, but even within this research community conceptual differences have existed.⁷

In the *Fourth Assessment Report* (AR4), the WG II has extensively used the concepts of ‘vulnerabilities’, ‘vulnerability assessment’ and ‘vulnerability hotspot’ (IPCC 2007a: 974–975) with regard to Africa, Amazonia, Asia, Australia and New Zealand, Latin America, coastal systems and mega-deltas. For the AR4:

Vulnerability to climate change is the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change. The term ‘vulnerability’ may therefore refer to the vulnerable system itself (e.g. low-lying islands or coastal cities), the impacts to this system (e.g. flooding of coastal cities and agricultural lands or forced migration), or the mechanisms causing these impacts (e.g. disintegration of the West Antarctic ice sheet). Based on a number of criteria in the literature (i.e., magnitude, timing, persistence/reversibility, potential for adaptation, distributional aspects, likelihood and ‘importance’ of the impacts, some of these vulnerabilities might be identified as ‘key’. Key impacts and resultant key vulnerabilities are found in many social, eco-

nomie, biological and geophysical systems (IPCC 2007a: 73).

These potential key vulnerabilities are to help decision-makers to identify “levels and rates of climate change that may be associated with ‘*dangerous anthropogenic interference*’ (DAI) with the climate system”. The Technical Summary of the AR4 also points to the link with “systemic thresholds where non-linear processes cause a system to shift from one major state to another”. Besides these potential ‘tipping points’ of the climate system (Lenton/Held/Kriegler/Hall/Lucht/Ramstorf/Schellnhuber 2008) key vulnerabilities may be linked to “‘normative thresholds’ defined by stakeholders or decision-makers (e.g. a magnitude of sea-level rise no longer considered acceptable by low-lying coastal dwellers)” (IPCC 2007a: 73). AR4 argues that “some key vulnerabilities have been associated with observed climate change”, such as “increases in human mortality during extreme weather events, and increasing problems associated with permafrost melting, glacier retreat and sea-level rise”. AR4 distinguished among three different climate change regimes associated with a global mean temperature increase of up to 2°C, between 2 to 4°C, and above 4°C until the end of the 21st century.⁸

With regard to security risks posed by climate change, the WBGU (2008: 242) defined vulnerability as “the susceptibility of a social group or (environmental) system to →crises and pressures” by distinguishing between social and biophysical vulnerability. The report of the UN Secretary-General on “Climate change and its possible security implications” (UN-SG 2009: 1) approached this linkage “from a perspective of interdependence between human vulnerability and national security” and it identified ‘vulnerability’ among the five channels through which climate change could affect security, arguing that “Climate change threatens food security and human health, and increases human exposure to extreme events,” especially for the poor countries that “are among the most vulnerable, and the best way to reduce their vulnerability is to help lift them out of poverty”. The use of the vulnerability concept by the climate community

7 There is an extensive literature on the vulnerability concept as used by the climate change community, see e.g. Füssel (2007); O’Brien, Eriksen, Nygaard and Schjolden (2007); Roberts and Parks (2007); Adger (2006); Kates and Millman (1990); Kates and Millman (1990); Füssel and Klein (2006); Watts and Bohle (1993); Bohle (2001); Bohle, Downing, Watts (1994); Ribot (1995); Turner II, Matson, McCarthy, Corell, Christensen, Eckley, Hovel-srud-Broda, Kasperson, Luers, Martello, Mathiesen, Naylor, Polsky, Pulsipher, Schiller, Selin and Tyler (2003).

8 Table TS.8 in the Technical Summary of WG II of the Fourth Assessment Report of the IPCC (2007a: 74) offers an overview of the key vulnerabilities of the global social, regional, biological and geophysical systems as well as of the risks from extreme events for global average temperature changes from 0°C up to 5°C above 1990.

partly overlaps with its employment by the natural hazard community.

2.4.5 Vulnerability as a Political and Scientific Concept in the Hazard Research Community

From the perspective of the hazard research community, Blaikie, Cannon, Davis and Wisner (1994) redefined vulnerability commonly used as “being prone to or susceptible to damage or injury”. Their working definition is:

By ‘vulnerability’ we mean the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone’s life and livelihood is put at risk by a discrete and identifiable event in nature or in society. ... We use the term to mean those who are more vulnerable. When used in this sense, the implied opposite of vulnerable is sometimes indicated by our use of the term *secure*. ... Our definition of vulnerability has a time dimension built into it. Since it is damage to livelihood and not just life and property that is at issue, the more vulnerable groups are those that also find it hardest to reconstruct their livelihoods following disasters. ... Our focus on vulnerable people leads to give secondary consideration to natural events as determinants of disasters. Normally, vulnerability is closely correlated with socio-economic position.

In the context of the research on hazards the concept of *vulnerability assessment* was used to refer to an: “evaluation of the sensitivity of a particular ecosystem, resource or activity to a broad range of environmental and socio-economic stresses” (Bass 2002: 346–347). According to Hewitt (2002: 299) a vulnerability perspective “considers especially how communities are exposed to dangers, the ways in which they are readily harmed, and the protection that they lack”. Vulnerability to a hazard is to a large extent created by the respective social order on the division of labour, cultural values and on legal rights. Thus, according to Hewitt (2002: 300), vulnerability is a “relative condition, and can only be defined and assessed in relation to the safety which others actually enjoy”.⁹

The *International Strategy on Disaster Reduction* (ISDR 2002: 24, 342) defined *vulnerability* “as a set of conditions and processes resulting from physical, social, economical, and environmental factors, which increase the susceptibility of a community to the impact of hazards”. These conditions are shaped “continually by attitudinal, behavioural, cultural, socio-economic and political influences at the individuals, families, communities, and countries”. Vulnerability is closely linked to development.

Physical factors include the location and susceptibility of the built environment and are often influenced by the “density levels, remoteness of a settlement, its sitting design and materials used for critical infrastructure and for housing”. Among the *social factors*, at the level of individuals, communities and society, ISDR (2002: 47) listed “levels of literacy and education, the existence of peace and security, access to basic human rights, systems of good governance, social equity, positive traditional values, knowledge structures, customs and ideological beliefs, and over all collective organizational systems”. Vulnerability highly depends on *economic factors*, including poverty, “individual, community and national economic reserves, levels of debt and the degree of access to credit and loans as well as insurance”, but also access to communication networks and socio-economic infrastructure. Finally, among the *ecological factors*, ISDR (2002: 47, 60) referred to the “very broad range of issues in the inter-acting social, economic and ecological aspects of sustainable development as it relates to disaster risk reduction” and distinguished among: “1) the extent of natural resource depletion; 2) the state of resource degradation; 3) loss of resilience of the ecological systems; 4) loss of biodiversity; and 5) exposure to toxic and hazardous pollutants.”

Efforts to increase the ability of people “to cope effectively with hazards, and that increase their resilience, or that otherwise reduce their susceptibility, are considered as *capacities*” (ISDR 2002: 23–24). Vulnerability to hazards is higher in many developing countries, where they are “exacerbated by socio-economic and environmental conditions”, including “the occupation of hazard-prone areas, the concentration of industrial infrastructure and critical facilities” (ISDR 2002: 62–64).

For disaster reduction, vulnerability and capacity assessment is essential (ISDR 2002: 69–78) which was addressed initially by the ISDR Interagency Task Force Working Group 3 on Risk, Vulnerability and Impact Assessment which has become the Global Platform for Disaster Reduction.¹⁰ A lot of work has been

⁹ See for more recent literature on vulnerability and disasters: Cannon (2000); Downing (1991); Kaspersen, Dow, Archer, Caceres, Downing, Elmquist, Eriksen, Folke, Han, Iyengar, Vogel, Wilson and Ziervogel (2005); Smucker and Wisner (2008); Cannon, Twigg and Rowell (N.d., 2003?); Wisner, Blaikie, Cannon and Davis (2004).

done on methodologies and instruments for *Vulnerability and Capacity Assessment* (VCA) and in the framework of a *Capabilities and Vulnerability Analysis* (CVA), together with the International Federation of the Red Cross (IFRC 2002) as a major proactive promoter. The ISDR (2002: 78) considered hazard, vulnerability and capacity as “the operational basis for a culture of prevention” with four priority areas:

- Risk assessment for decision-making;
- Terminology, data and methodology;
- Higher visibility and priority to reduce vulnerability and strengthen capacities; and
- Addressing new trends in hazard and vulnerability.

ISDR (2002) defined vulnerability as: “a set of conditions and processes resulting from physical, social, economical and environmental factors, which increase the susceptibility of a community to the impact of hazards”, while UNDP (2004) stressed “a human condition or process resulting from physical, social, economic and environmental factors, which determine the likelihood and scale of damage from the impact of a given hazard”. The ISDR (2002) definition juxtaposed vulnerability with its complementary component capacity, which is defined as “a combination of all strengths and resources available within a community or organization that can reduce the level of risk or the effects of a disaster”.

Bohle (2001, 2002) distinguished between *external* (environmental) and *internal* (human) vulnerability,

thus clearly identifying vulnerability as a potentially detrimental social response to environmental events and changes. Vulnerability can cover susceptibilities to a broad range of possible harms and consequences; it implies a relatively long time period, certainly exceeding that of the extreme event itself, which might have triggered its exposure. This interpretation of vulnerability is unavoidably related to resilience, the ability to return to a state similar to the one prevailing prior to the disaster. Thus, vulnerability is not only ill-defined, but its manifestation and magnitude depend on many partially unknown factors and their coincidence.

10 See at: <<http://www.preventionweb.net/english/hyogo/GP/>>. The Global Platform is the main global forum for representatives of governments and other stakeholders ... to: 1. Assess progress made in implementation of the Hyogo Framework for Action. 2. Enhance global awareness of disaster risk reduction. 3. Share experiences among countries and learn from good practice. 4. Identify remaining gaps and actions needed to accelerate national and local implementation of the Hyogo Framework.

Plate (2002) recommended a critical index of vulnerability measured as the distance between the part of the GNP per person needed for maintaining minimum social standards and the available GNP per person. This index would focus on the financial resources available within a society or a community, or even an individual household that can reduce the effect of a disaster. This vulnerability measure would cover only some problems, while the environmental dimension cannot adequately be expressed in monetary terms.

Bogardi and Birkmann (2004) analysed the potential of vulnerability assessment for sustainable risk reduction, given the uncertainty of the vulnerability concept that was defined by Wisner (2002) as the “likelihood of injury, death, loss, disruption of livelihood or other harm in an extreme event, and/or unusual difficulties in recovering from such effects”. They call for more direct indicators of national and regional scale which could be linked to strategic goals and instruments of vulnerability assessment. For them “an interdisciplinary approach will be essential to take into account economic, social and environmental consequences as well as different objects of protection (individual, community features). While the potential economic losses caused by floods can often be quantified and estimated, methods and data to measure social, cultural, institutional and environmental features of vulnerability and coping capacity are still not sufficiently developed”. The vulnerability concept has also been used by those researchers who have worked on early warning of hazards while other concepts have been used by those who work on early warning of conflicts.

With regard to cities, for Satterthwaite, Huq, Reid, Pelling and Romero Lankao (2009: 19):

vulnerability to climate change is understood to mean the potential of people to be killed, injured or otherwise harmed by the direct or indirect impacts of climate change. This is most obvious with regard to risk from extreme events (such as storms or floods); but it includes risk from direct impacts – for instance, declining freshwater availability or livelihoods dependent upon climate sensitive resources.

Sherbinin, Schiller and Pulsipher (2009: 131) framed vulnerability of global cities to climate hazards as “the degree to which a system or unit is likely to experience harm due to exposure to perturbations or stresses”. They argued that by using this concept it became clear

that the ability of a system to attenuate stresses or cope with the consequences through various strategies or

mechanisms constituted a key determinant of system response, and ultimately, of system impact. ... Vulnerability in the social sciences is typically identified in terms of three elements: systems exposure to crises, stresses and shocks; inadequate system capacity to cope; and consequences of attendant risks of slow (or poor) system recovery. ... The most vulnerable individuals, groups, classes and regions or places are those that experience the most exposure to perturbations or stresses; are the most sensitive to perturbations or stresses (i.e. most likely to suffer from exposure), and have the weakest capacity to respond and ability to recover.

They aimed at ‘gap analysis’ of areas of exposure and vulnerability pointing “to areas of greatest need for strengthened adaptive capacity and risk management” (Sherbinin/Schiller/Pulsipher 2009: 132). By linking a scenario-based ‘top-down’ approach with ‘bottom-up’ assessments using vulnerability mapping techniques they reached a better understanding “of likely future climate impacts while assessing the resilience of the current socio-ecological system in the face of bundles of stresses that are partly related to climate impacts and partly to fragilities in the system itself” (Sherbinin/Schiller/Pulsipher 2009: 152).

In an extensive review of the vulnerability concept in disaster management, environmental change and development research, Birkmann (2006: 16) stated that “the concept is still somewhat fuzzy and often used with different connotations” and that it would be “misleading to try to establish a universal definition”. In his review of the literature, Birkmann (2006: 17–39) distinguished among five key spheres of the vulnerability concept: a) vulnerability as an internal risk factor (intrinsic vulnerability); b) vulnerability as the likelihood to experience harm (human centred); c) vulnerability as a dualistic approach of susceptibility and coping capacity; d) vulnerability as a multiple structure: susceptibility, coping capacity, exposure, adaptive capacity; and e) multi-dimensional vulnerability encompassing physical, social, economic, environmental and institutional features. After a review of the different conceptual and analytical frameworks pertaining to vulnerability Birkmann (2006: 39–40) distinguished among at least six different schools:

- the school of the double structure of vulnerability (Bohle 2001, 2002);
- the analytical framework for vulnerability assessment of the disaster risk community (Davidson 1997; Bollin/Cárdenas/Hahn/Vatsa 2003);
- the analytical framework for vulnerability assessment in the global change community (Turner/Kasperson/Matson/McCarthy/Corell/Chris-

tensen/Eckley/Kasperson/Luers/Martello/Polsky/Pulsipher/Schiller 2003);

- the school of political economy, which addresses the root causes, dynamic pressures and unsafe conditions that determine vulnerability (Wisner/Blaikie/Cannon/Davis 2004);
- the holistic approach to risk and vulnerability assessment (Cardona 1999a, 2001, chap. 3 below; Cardona/Barbat 2000; Carreño/Cardona/Barbat 2004, 2005a, 2005b);
- the BBC conceptual framework, which places vulnerability within a feedback loop system and links it to the sustainable development discourse (Bogardi/Birkmann 2004; Cardona 1999, 2001).

However, the use of the ‘vulnerability concept’ has not been limited to these six schools but it was also in the broader environment, development and early warning community (2.4.6) and in peace research and security studies (Albrecht/Brauch 2008, 2009; Buzan/Hansen 2009) and in security policy both during the Cold War period and less in the post-Cold War US national security strategy documents (chap. 12 by Brauch).

2.4.6 Vulnerability in the Environment, Development and Early Warning Community

The vulnerability concept has also been widely used in the broader environment, in the development (Naudé/Santos-Paulina/Mc Gillivray 2009) and also in the two early warning communities with regard to natural hazards and conflicts and by officials in the respective offices of international organizations (UNDP, UNEP, UNISDR et al.).

Pascal Peduzzi (2000: 2), head of the Early Warning Unit at UNEP/DEWA/GRID-Europe and of a team of authors have contributed together with UNEP to the development of key indicators for ‘global vulnerability and risk mapping’. Initially he defined *risk* as “a measure of the expected losses due to hazard event of a particular magnitude occurring in a given area over a specific time period” (Tobin/Montz 1997) and *vulnerability* as “the degree of loss to each element should a hazard of a given severity occur” (Coburn/Spence/Pomonis 1991: 49) and as the “expected percentage of population loss due to socio-politico-economical context”.

In their feasibility study report on “Global Risk and Vulnerability Index”, Peduzzi, Dao, Herold, Rochette and Sanahuja (2001) and their ‘GRAVITY-Team’ defined vulnerability as: “the extent to which a

community, structure, service or geographic area is likely to be damaged or disrupted by the impact of a particular hazard" (Tobin/Montz 1997). They separated vulnerability into *geophysical* (low evaluation along the sea, high vulnerability to Tsunami), *socio-economical* parameters (cultural, technical, economic factors using indicators as: GDP, literacy, life expectancy, corruption, population density, and (urban population growth), and *mitigation capacities*.

Vulnerability cannot be directly measured but estimated "by a set of socio-economic variables and compared to actual disaster losses as reported by CRED" (*Centre for Research on Epidemiology of Disasters* in Louvain, Belgium). It "measures how easily the exposed people, physical objects and activities may be affected in the short or long-term". Vulnerability can be defined as "what turns a hazard into a disaster" (Peduzzi/Dao/Herold/Rochette/Sanahuja 2001: 45). They distinguish between *economic* (impact of a disaster on the economy), *human* (human losses and injuries) and *social vulnerability* (social structure influences the impact of a hazard, e.g. on women, families etc.). Vulnerability is specific to a hazard and a region. To measure vulnerability they used disaster data (especially on observed damages) from the CRED database and socio-economic indicators.

In their report on "Phase II: Development, analysis and results" Peduzzi, Dao, Herold (2002: 4-5) and the GRAVITY-Team noted that the vulnerability concept "is perhaps the most difficult to approach" (Coburn/Spence/Pomonis 1991: 49) and "depends on socio-politico-economical context of this population" where vulnerability factors are "socio-economic factors having an influence on the level of losses for a given hazard type".

In their report on "Phase III: Drought analysis", Peduzzi, Dao, Herold and Muton (2003: 4-5) and the GRAVITY-Team focused both on the natural and human induced (conflicts, bad governance) causes of this complex hazard and developed indicators for drought and food insecurity. They distinguished among eight vulnerability indicators, which they grouped as a) *economic* (GDP, HDI); b) *type of economic activities* (percentage of agriculture's dependency for GDP, of labour force in agricultural sector); c) *dependency and quality of the environment* (human induced soil degradation: GLASOD); d) *development* (HDI); and e) *health and sanitation* (percentage of people with access to safe water, mortality rate of under five-year-olds).

In their report on "Phase IV: Annex to WVR and Multi Risk Integration", Dao and Peducci (2003: 1)

described the "concepts, data and methods applied to achieve the Disaster Risk Index (DRI)". They offered two definitions of vulnerability. The first is reflecting "the range of potentially damaging events and their statistical variability at a particular location" (Smith 1996), and the second is pointing to "the degree of loss to each element should a hazard of a given severity occur" (Coburn/Spence/Pomonis 1991: 49). As a specificity of their research they noted "the discrepancies of casualties induced by different vulnerabilities are used to identify socio-economical indicators reflecting such vulnerabilities".

They also broadened the scope of their *vulnerability indicators* and distinguished them for two types of hazards: drought, and floods, cyclones and earthquakes; and nine categories of vulnerability: 1) *economic* (GDP, HDI, debt, inflation, unemployment); 2) *type of economic activities* (arable land, urban population, percentage of agriculture's dependency for GDP, of labour force in the agricultural sector); 3) *dependency and quality of the environment* (forests, woodlands, per cent of irrigated land, human induced soil degradation: GLASOD); 4) *demography* (population growth, urban growth, population density, age dependency ratio); 5) *health and sanitation* (calorie supply per person, access to sanitation, safe water, physicians, hospital beds, life expectancy, mortality rate of under five year of age); 6) *politics* (corruption); 7) *early warning capacity* (number of radios); 8) *education* (illiteracy, school enrolment, secondary, labour force with primary, secondary or tertiary education); and 9) *development* (HDI).

The UNDP (2004) report on *Reducing Disaster Risk - A Challenge for Development* includes a *Disaster Risk Index* (DRI) - developed by the GRAVITY-Team - which provides decision-makers with an overview of risk and vulnerability levels in different countries. This risk is measured in terms of the number of deaths during disasters. The Report has defined 'human vulnerability' as a

human condition process resulting from physical, social, economic and environmental factors, which determine the likelihood and scale of damage from the impact of a given hazard. In the DRI, human vulnerability refers to the different variables that make people more or less able to absorb the impact and recover from a hazard event. The way vulnerability is used in the DRI means that it *also* includes anthropogenic variables that may increase the severity, frequency, extension and unpredictability of a hazard (UNDP 2004: 98).

Based on their previous work, Dao and Peducci (2004) discussed methodological aspects of the *Disaster Risk Index* (DRI) in the UNDP (2004) report on

Reducing Disaster Risk. The report is based on the assumption “that differences in risk levels faced by countries with similar exposures to natural hazards are explained by socio-economic factors, i.e. by the population’s vulnerability” with a special focus on “socio-economical indicators reflecting human vulnerability to hazards”. They used a total of 38 variables dealing with economic features, dependency on environment quality, demography, health and sanitation, politics, infrastructure, early warning and capacity of response, education and development, and they discussed the global risk and vulnerability patterns for four hazards: cyclones, droughts, earthquakes, and floods. The concept ‘social vulnerability’ has been extensively used both in the development and in the hazard community.

2.4.7 ‘Social Vulnerability’ in the Hazard and Development Research and Policy Community

‘Social vulnerability’ has been used in many definitions in the hazard research community to distinguish the social and societal factors from the manifold physical, economic, political and human aspects (Adger 1999; Cutter/Boruff/Shirley 2003; Downing/Patwardhan 2005; Warner 2007). In the development policy community in the UK, a DFID (Department for International Development) White Paper (1997) and a policy paper (1999: 4) focused on socio-economic factors that made people vulnerable to disasters. It listed among its humanitarian policy goals “to save lives and relieve suffering, hasten recovery, and protect and rebuild livelihoods and communities, and reduce risks and vulnerability to future crises” thus stressing the link between “the sustainability approach and vulnerability reduction”. Cannon, Twigg and Rowell (2003: 4) argue that vulnerability analysis can “become an integral part of humanitarian work ... [and] enable [this] work to be more closely integrated with the SL [sustainable livelihood] approach, by using vulnerability analysis in both the operation of emergency preparedness and reducing poverty”. In their view:

[V]ulnerability should involve a *predictive* quality: it is supposedly a way of conceptualizing what may happen to an identifiable population under conditions of particular risks and hazards. ... VA should be capable of directing development aid interventions, seeking ways to protect and enhance peoples’ livelihoods, assist vulnerable people in their own self-protection, and support institutions in their role of disaster prevention (Cannon/Twigg/Rowell 2003: 4).

Disasters occur when a natural hazard affects a population unprepared to recover without assistance. The impacts of hazards differ for people at different levels of preparedness, resilience, and with varying capacities for recovery.

Vulnerability ... involves much more than the likelihood of their being injured or killed by a particular hazard, and includes the type of livelihoods people engage in, and the impact of different hazards on them. ... Social vulnerability is the complex set of characteristics that include a person’s

- *initial well-being* (nutritional status, physical and mental health, morale);
- *livelihood and resilience* (asset pattern and capitals, income and exchange options, qualifications);
- *self-protection* (the degree of protection afforded by capability and willingness to build safe home, use safe site);
- *social protection* (forms of hazard preparedness provided by society more generally, e.g. building codes, mitigation measures, shelters, preparedness); and
- *social and political networks and institutions* (social capital, but also role of institutional environment in setting good conditions for hazard precautions, peoples’ rights to express needs and of access to preparedness) (Cannon/Twigg/Rowell 2003: 5).

According to the DFID study, the vulnerability conditions are distant from the impact of a hazard. Vulnerability variables are connected with peoples’ livelihoods and poverty. Thus, development work should reduce disaster vulnerability and make people become more resilient to hazards by

- the strengthening of peoples’ ‘base-line’ conditions (nutrition, health, morale ...);
- reinforcement of their livelihood and its resilience to possible hazard impacts;
- peoples’ own efforts ... to reinforce their home and workplace against particular hazards;
- or by access to proper support ... by institutions of government or civil society (Cannon/Twigg/Rowell 2003: 6).

Livelihoods are influenced by *social and political networks* that may have varying levels of cohesion and resilience in the face of hazards. When disasters occur, relief and recovery is tied with the restoration of livelihoods, and the strengthening of self-protection. Vulnerability can be seen as a term that encompasses all levels of exposure to risk. There are two separate approaches to vulnerability and capacity. The first conceives people who have a high degree of vulnerability and are low in capacity. The second perceives them as two distinct sets of factors. A capacity

might include institutional membership, group cohesion or literacy. Vulnerability can include poverty, house quality, or illiteracy. Some capacities are not the opposite of vulnerabilities, and some low-level vulnerability characteristics are not amenable to being considered capacities.

The concept of ‘capabilities’ (Sen 1981, 1999; Comin/Qizilbash/Alkire 2008) emerged in response to the term ‘vulnerability’. It was suggested that speaking of people as being vulnerable ignored many capacities which make them competent to resist hazards. Some characteristics may be considered capacities when they score well, and vulnerabilities when they score badly, even when they are in fact opposite ends of a scale. There can be high and low levels of vulnerability without implying victimhood.

One of the reasons why capacities seem to be often separated from vulnerability is that capacities are regarded as dependent on groups or some form of social organization, while vulnerabilities are socially-determined. One way around the problem is simply to acknowledge that high capacities likely reduce the vulnerability. If we accept that measuring vulnerability includes any factor or process that can alter the exposure of a person or household to risk, then capacities can also be considered as scaled factors leading to greater danger (vulnerability) when they are low, and reduced danger when they are high.

Vulnerability analysis offers DFID the opportunity to integrate development work with disaster preparedness, prevention and recovery. By adopting a *vulnerability assessment* (VA) approach, disaster prevention, preparedness and recovery work should be integrated with development work. With VA as a means of integrating its development and disaster work, DFID may also be able to foster a better integration and convergence of the wide range of vulnerability and capacity methods what can assist in its work of creating partnerships.

Since 2005, the MunichRe Chairs on Social Vulnerability of UNU-EHS have made significant contributions to the theoretical and conceptual development of social vulnerability, in relation to *Gender and Disasters* (Oswald Spring 2008, 2001), on *Livelihoods and Human Security in Risky Environments* (Bohle 2007), and on *Sea Level Rise and the Vulnerability of Coastal Peoples* (Oliver-Smith 2009) and on *Nature, Society, and Population Displacement* (Oliver-Smith 2009a). In the first three summer academies of UNU-EHS, PhD candidates from many disciplines and all parts of the globe provided theoretical and empirical inputs to the debate on social vulnerability with a

focus on *Perspectives on Social Vulnerability* (Warner 2007); on *Megacities - Resilience and Social Vulnerability* (Bohle/Warner 2008) and on *Linking Environmental Change, Migration & Social Vulnerability* (Oliver-Smith/Shen 2009).¹¹

From the review of many scientific vulnerability concepts used in the global change, climate change, hazard, environment, development and early warning communities no consensus has emerged on a definition, on criteria and indicators for the measurement of vulnerability. For the hazard community, vulnerability is the combination of additional contributing factors causing a hazard due to natural variability or human inducement to a disaster. The selection and inclusion of these contributing factors is configured by the worldview, mind-set, perception, the theories and models of the analyst. Thus, vulnerability is always socially constructed. ‘Vulnerability’ is how the analyst or policy-maker has defined it, and which definition has become accepted by a consensus within the respective research community.’

2.4.8 The Vulnerability Concept in Strategic and Security Studies

During the Cold War period, the concept of vulnerability was widely used for technical systems (e.g. of the land based strategic deterrent with regard to both intercontinental bombers and fixed land-based ICBMs), critical military and command, control and communication infrastructure but also of urban centres and the highly sensitive industrial and transportation systems. Since the global turn of 1990, at least in US national security guidance papers this concept has been used much less and with a specific meaning (chap. 12 by Brauch).

2.5 Reconceptualizing ‘Security Risks’

2.5.1 The Term ‘Risk’

For the term ‘risk’ (Lat.: ‘risicare’ navigate around cliffs; Fr.: ‘risque’; It.: ‘risico, risco’; Sp.: ‘riesgo’; Port.:

11 Selected contributions by participants are included in part IV of this book (see chap. 30–38 by Fabien Nathan (France); Mabel-Cristina Marulanda and Carmen Lacambra (Colombia); Monalisa Chatterjee, Reena Singh and Nanda Kishor (India) Xiaomeng Shen (China); Sidika Tekeli-Yesil, and Ebru Gencer (Turkey).

‘risco’; Ger.: ‘Risiko’) many synonyms are used: danger, peril, jeopardy, hazard; chance, gamble, possibility, speculation, uncertainty, venture; unpredictability, precariousness, instability, insecurity, perilousness, riskiness, probability, likelihood, threat, menace, fear, prospect.

For *Webster’s Third International Dictionary* ‘risk’ means “1. the possibility of loss, injury, disadvantage, or destruction: contingency, danger, peril, threat ...; 2. someone or something that creates or suggests a hazard or adverse chance: a dangerous element or factor ...; 3. the chance of loss or the perils to the subject matter or insurance covered by the contract; the degree of probability of such loss; amount at risk; a person or thing judged as a specified hazard to an insurer; an insurance hazard from a cause or source (war, disaster); 4. the product of the amount that may be lost and the probability of losing it” (Gove 2002: 1961). Langenscheidt-Longman (1995) defines ‘risk’ as: “1. possibility of bad result: the possibility that something bad, unpleasant, or dangerous may happen ...; 2. take a risk: to decide to do something even though you know it may have bad results; 3. at risk: be in a situation where you may be harmed ...; 4. run a risk: to be in a situation where there is a risk of something bad happening to you ...; 5. at the risk of doing something: used when you think that what you are going to say or do may have a bad result, may offend or annoy people etc.; 6. at your own risk: if you do something at your own risk, you do it even though you understand the possible dangers and have been warned about them; 7. cause of dangers: something or someone that is likely to cause harm or danger...; 8. insurance/business: a person or business judged according to the danger involved in giving them insurance or lending them money” (Langenscheidt-Longman 1995). *The Oxford Guide to the English Language* gives this concise definition: “possibility of meeting danger or suffering harm; person or thing representing a source of risk” (Weiner/Hawkins 1985).

Besides these many meanings of this term in contemporary American and British English, the ‘risk’ concept has been employed in many natural and social science disciplines as a concept that is also widely used by policy-makers to justify specific policy goals and programmes.

2.5.2 Risk as a Political and Scientific Concept in Encyclopaedias

As a scientific concept, risk is defined in major encyclopaedias and scientific dictionaries in many disci-

plines, including philosophy, political science, sociology, psychology, economics and in the geosciences. The *Brockhaus Enzyklopädie* (191992, XVIII: 440-444) offers a detailed assessment of the different meanings of the term ‘risk’, of its historic development, as well as ‘risk measures’, ‘risk assessment’, ‘risk factors’ and ‘risk indicators’, ‘risk society’, ‘risk capital’, ‘risk policy and management’ and ‘risk premiums’. The *Brockhaus* distinguishes among these meanings of risk: 1. a possibility that an action or activity causes damage or loss of material or persons; and 2. risk is used when the consequences are uncertain. The *Brockhaus* differentiates among *pure* (crash of an airplane), *speculative* (stock market), *insured* and *technical risks* (of equipment).

For the quantitative measurement of risks, often simple risk indicators are used: ‘Risk estimates’ always involve a prospective estimate based on the probability, frequency and intensity of damages that are often based on specific ‘risk analyses’. ‘Risk assessment’ is used in the daily practice in many disciplines and it is often influenced by the personal risk acceptance. The risk assessment e.g. of nuclear technologies differs among groups and countries. The concept ‘risk factors’ is used in social medicine, public health and epidemiology to point to factors which may increase the probability to get affected by a disease, while risk indicators may also be indirect contributing factors (e.g. social conditions for the breakout of a disease). Beck’s (1986, 1992, 1999, 2007, preface essay by Beck) concept of an (international) ‘risk society’ initiated a global debate in the social sciences that impacts on security risks. ‘Risk policy and politics’ as well as ‘risk management’ comprise all measures of an enterprise to improve its financial performance.

2.5.3 Risk as a Political and as a Scientific Concept in Scientific Dictionaries

The term ‘risk’ evolved since the 15th century referring to the financial danger associated with trade. This concept was primarily used with reference to insurance in economic activities. The term is widely employed in the *probability theory* (Bernoulli 1738, Laplace 1816), in *economics* (A. Smith 1776, Ricardo 1821, J.S. Mills 1848, Knight 1921), in *existential philosophy* (Kierkegaard 1844, Heidegger, Jaspers 1932, 1956, Sartre 1948, Camus 1958) and in *decision-making theory* (Neumann/von Morgenstern 1944). The risk concept is used as a political term in nuclear technology for estimating how much security of technology is needed and how much insecurity is acceptable

for society. Here risk is equated with the expectation of security contributing to risk acceptance. Since the 1970's the concept has been intensively discussed in economics, psychology, sociology and political science (Rammstedt VIII, 1992: 1049). Koschnick (1993: 1325) refers to 'risk' in the context of decision-making theory where

risk is defined as imperfect information, leading to a situation in which one is forced to take chances that certain outcomes or events will occur. Risk can range from risk that is close to perfect uncertainty to risk that approaches perfect uncertainty. ... In face of risk, one may proceed in three stages. First, one evaluates the various possible consequences of alternative policies on their merits. Second, one specifies the probability relationships between given policies and these evaluated outcomes. And finally, one tries to rank policies by the probabilistically weighted values of the consequences to which they may lead.

As complete certainty is hardly possible, Llewellyn (1996: 744-746) argues that "risk and uncertainty are an integral part of most human behaviour", especially in economics and finance: "*Uncertainty* arises when the future is unknown but no actual probabilities (objective or subjective) are attached to alternative outcomes. *Risk* arises when specific numerical probabilities are attached to alternative outcomes." *Risk analysis* relies on probability theory.

Behaviour is ... influenced both by the risk of an event to occur or outcome and the potential seriousness if it occurs. This ... gives rise to the concept of *disaster* myopia. ... Risk analysis is applied to situations which have multiple, uncertain outcomes. ... Risk analysis and management for a bank involves five key processes: first, identification and measurement of risk...; second, what can be done to lower the probability of default; third, measures to limit the damage in the event that the risk materializes...; fourth, action to shift risk to others, that is, risk-sharing, and fifth, how the residual risk is absorbed. ... The same principles apply in all risk analysis. ... Risk analysis is inseparable from risk management.

An economic dictionary (Grüske/Recktenwald 1995: 528-529) includes 'risk', 'risk premium', 'risk theory' and 'risk management' where 'risk' is defined

as an economic and social danger of loss in reputation, position, wealth resulting from the market dependence of the entrepreneur and the financier. In the economy it is closely linked with responsibility. Knight distinguishes between risk, where the probable distribution of results of possible actions is known and insecurity where this is not the case. Thus, insecurity cannot be measured and cannot be insured against, while risks may be insured against. In the literature the risk concept is manifold: 1)

the danger to make a loss, or the distance between possible profit and loss; 2) risk expresses the positive and negative deviation from the expected value, or 3) risk as the difference between the planned data and the facts. ... The risk policy of companies tries to remove unnecessary risks, ... as a result of careful market analyses and to secure it legally. ... Decision theory has developed ... procedures, to constrain risks (Grüske/Schneider 2003: 456).

Grüske and Schneider (2003: 456) defined risk management as: "The analysis of risks as well as the implementation of measures to manage risks". This covers insurance contracts of households, strategies of companies to differentiate production, and speculation in money markets as part of risk management. A major task of risk management is risk limitation.

In psychology 'risk' (Städtler 2003: 937-938) is used in decision-making theories, especially for decision situations taken under risk, synonymously for decision and decision behaviour. Risk implies that individuals show in decisions variance preferences that do not always follow the principle of maximizing benefits, but also reflect the relationship between maximum gain and loss. The portfolio theory of risks by Coombs (1975) implies a preference function for risks where the optimal value of risk is to find a balance between greed, challenge and fear. Some theories try to explain the risk-taking behaviour of humans given possible cognition of dangers.

The risk concept was gradually introduced in sociology, with a reference to environmental issues. In a German dictionary of sociology (Endruweit/Trommsdorff 1989) the term 'risk' was still missing, while in a sociological lexicon (Fuchs/Klima/Lautmann/Rammstedt/Wienold 1978, 1988) 'risk' was included as "readiness to take risks" (*Risikobereitschaft*), as "risk population" and as "risky shift". In the dictionary of sociology (Hillmann 1994: 740-741) risk is defined as a decision situation with incomplete information. In game and decision-making theory risk is distinguished from uncertainty. Subjective risk perceptions have often differed from the objective level of risk (Nathan 2010; chap. 30 in this vol.).

2.5.4 The Debate on 'Risk' and 'Risk Society' in the Social Sciences

The concept of risks has been used in the social sciences and especially in sociology, with a special reference to environmental issues.¹² Löfstedt and Frewer (1998, 2004: 3-27) reviewed the debates on 'risk management' tracing the origin of risk analysis to the response of psychologists to an engineer's work on

technological risks, and to the Chicago school of geography and argued that the people's response to hazards depended on their experience and knowledge. The debate on risk perception was provoked by Starr who pointed to the importance of contextual factors in risk perception pertaining to natural and technological hazards.

In the 1990's, a new school doubted the existence of objective risks pointing to the social construction of risk that influenced risk perceptions and risk-taking behaviour. Others have criticized risk comparisons because they ignored the societal risk context. A cultural theory of risks emerged in the UK but the empirical results in other countries were mixed. In the 1980's and 1990's research moved from 'risk perception' to 'risk communication' including the role of the media and of the social amplification of risk. In analysing the failure of risk communication initiatives, research increasingly has focused on the lack of trust towards policy-makers with regard to hazardous industrial plants and installations.

One reason for distrust has been the growing relevance of globalization (Giddens 1990, 1994).¹³ The concept 'risk society' was introduced by Ulrich Beck (1986, preface essay above) and has widely influenced the debate in the social sciences.¹⁴ Beck (1986, 1992) has argued that risk is increasing with the complexity of technology. Regaining trust requires competence and credibility of policy-makers. Research on mental models gained in importance focusing on misperceptions regarding different kinds of risks. Others have focused on the optimistic bias or the unreal optimism that has become a major barrier to effective risk communication. Due to the crisis of confidence, the requests on social scientists have increased to contribute

to an improved risk management. Löfstedt and Frewer (1998, 2004: 19–20) argue on the future of risk research that the model of social amplification of risk should be developed further, as well as the research on risk perception and risk communication, and on public responses to transboundary risks.

In his book *On Risk*, Bonß (1995) reviewed the development of the 'sociology of risk' that has gradually emerged since the late 1960's in response to the disasters of Seveso, Harrisburg, Bhopal or Chernobyl which Luhmann (1990: 138) has described as an "articulated displeasure". With his theory of a 'risk society', Beck tried to place the problem of risk in the context of a theory of modernity focusing primarily on technical dangers and less on social action. Bonß (1995: 18–19) suggested to broaden the sociological risk debates in two respects: 1) the linkage between risk and technology must be dissolved and it should be analysed as a problem of insecurity; and 2) from a historical perspective the treatment of uncertainty should be reconstructed. He offered a systematic history of the discourse on the risk concept as a social and cultural construct with a special focus on the transition from a reactive towards an active orientation of insecurity. Among several classifications of risk concepts Bonß pointed to two alternatives to analyse risk as a social phenomenon from an action (*ex ante*) or systems (*ex post*) perspective. From an action perspective, risks are reduced to risk decisions, while from a systems perspective risks are treated as threats or danger of loss. Bonß suggests analysing risks in the context of the social construction of uncertainties. While uncertainties due to dangers exist irrespective of human actions, uncertainties as risks include both the intentions and implementation of action. Thus, risks are often the result of decisions made under uncertainty.

12 Keith Smith (³2001: 6) noted that risk is sometimes used synonymously with hazards whereby "risk has the additional implication of the chance of a particular hazard actually occurring. ... *Risk* is the actual exposure of something of human value to a hazard and is often regarded as the product of probability and loss".

13 Tester (1996: 747) noted that risk is a major theme in Giddens's works who "distinguishes pre-modern (traditional) and modern environments of risk: 'The risk environment of traditional cultures was dominated by hazards of the physical world' while the modern risk environment is 'structured mainly by humanly created risks' (Giddens 1990). Giddens stresses the importance of the environment, war and personal relationships in modern experiences and construction of risk. In so doing, Giddens makes plain that 'risk is not just a major individual action. There are environments of risk that collectively affect masses of individuals'".

14 Tester (1996: 747) summarized and interpreted Beck's key concept of risk' and risk society': "In a risk society the future has become uncertain. Possible events which technology unintentionally generates cannot be insured against because they have unimaginable implications. *The residual risk society has become an uninsured society* (Beck 1992a: 101). Instead of belief in progress and the future, risk society is experienced in terms of short-term calculations of danger: 'In this sense, one could say that the calculus of risk exemplifies a type of ethics without morality, the mathematical ethics of the technological age (Beck 1992a: 99). ... He has faith in the potential of a self-critical technological enterprise to solve risk problems. Secondly, Beck emphasizes the sociological significance of the environment and ecology".

Jaeger, Renn, Rosa and Webler (2001: 9) reviewed the thinking of risk, uncertainty and rational action. In their view “risk developed over the past several decades as the key analytical lens for attempting to anticipate the consequences of our purposive actions on the environment and ourselves”. Risk has always been constitutive of the *conditio humana*. However, the nature of risks has changed, while they were originally local in impact, today many risks are eco-centric (i.e. they are linked to environmental problems or related to environmental conditions), and global. They are increasingly perceived as common risks, be it as systematic cumulative environmental risks, often affecting the globe as a whole (e.g. climate change), and the increasing risk consciousness of high technology. With the adoption of ‘risk’ as the imprimatur of our age, as suggested by Beck and Giddens, the direction of Western thought has shifted from “the expectation of progress, of continued improvement in the social world” to an epoch “in which the dark sides of progress increasingly come to dominate social debate”, shifting from the ‘goods’ of modernization to the often unintended ‘bads’ (Jaeger/Renn/Rosa/Webler 2001: 15).

In Giddens’ terminology (1984, 1991) social fabric produces “ontological security”¹⁵, he specified as “the confidence that most human beings have in the continuity of their self-identity and the constancy of the surrounding social and material environments of action” (1991: 92). Today they often “take the form of uncertainties, and risks associated with them”, i.e. increasing these risks results from human choice

15 Giddens (1991) calls the need for stable expectations, e.g. of states, ‘ontological security’. According to Mitzen (2005: 3) this refers to a “need to secure one’s identity. Actors do this through cognitive and behavioural routines; and because the resulting routines stabilize the self, actors become attached to them”. Based on Huymans (1998) and Mc Sweeney (1999), Mitzen (2005) argues that states also need ontological security and she proposes “that states achieve ontological security by routinizing relations with other states and apply that argument to entrenched interstate conflict. This reveals another, second ‘security dilemma’ in international politics: ontological security can impede physical security”. If states try to break out of security dilemmas, Mitzen (2005: 3–4) argues that this could “generate ontological insecurity”. Thus, “parties may prefer to remain in security dilemmas, even if offered credible opportunities for escape. In short, ontological security turns security dilemma logic on its head, suggesting that the persistence of conflict is rooted not in uncertainty but in the certainty such dilemmas offer their participants”.

threatening both environmental conditions and individual identity.

For Jaeger, Renn, Rosa and Webler (2001: 16) “reducing uncertainties in order to maintain ontological security is clearly a task worthy of sociological investigation”. With a special focus on risks, they discuss first rational action, as the dominant worldview “for understanding and managing risk”, and then shift to alternative approaches: “reflexive modernization, critical theory, systems theory, and postmodernism”. While there are many meanings of risk, they argue that “all conceptions of risk presuppose a distinction between *predetermination* and *possibility*” (Jaeger/Renn/Rosa/Webler 2001: 17).

Risk implies uncertainty, an indispensable element of risk. Risk “is present only to the extent that uncertainty involves some feature of the world, stemming from natural events or human activities that impacts human reality. Risk, in human terms, exists only when humans have a *stake in outcomes*”. Jaeger, Renn, Rosa and Webler (2001: 17) defined risk as “a situation or event in which something of human value (including humans themselves) has been put at stake and where the outcome is uncertain”.

In the late 20th century, for industrialized societies the new risks have reached a level that could endanger human life and survival on the planet. Technological and industrial developments have created new dangers that could endanger life in all its forms. These new risks for survival cannot be geographically limited nor can they be insured against. The competition on the division of resources has partly been replaced by the management of these global risks of survival. They require a reflexive modernization where prevailing views, values, norms, conventions and behavioural patterns are an object of sociological reflection (Hillmann 1994). Ulrich Beck (1999: 3–4) defined ‘risk’ as

the modern approach to foresee and control the future consequences of human action, the various unintended consequences of radicalized modernization. It is an (institutionalized) attempt, a cognitive map, to colonize the future. Every society has ... experienced dangers. But the risk regime is a function of a new order: it is not national, but global. ... Risks presuppose decision. These decisions were previously undertaken with fixed norms of calculability, connecting means and ends or causes and effects. These norms are precisely what ‘world risk society’ has rendered invalid. ... What has given rise to the prominence of risk? The concept of risk and risk society combines what once was mutually exclusive – society and nature, social sciences and material sciences, the discursive construction of risk and the materiality of threats.

Beck (1999: 55–57) distinguished between predictable *risks* and unpredictable *threats* and offered a typology of three types of global threats: 1) *wealth-driven* ecological destruction and technological-industrial dangers (ozone hole, global warming, regional water shortage) and the unpredictable risk of genetic engineering; 2) risks related to *poverty* (environmental destruction); and 3) *weapons of mass destruction*.

Zürn (1995: 51) saw an essential difference between environmental destruction as a result of well-being and poverty: “Whereas many wealth-driven ecological threats stem from the externalization of production costs, in the case of the poverty-driven ecological destruction it is the poor who destroy themselves with side-effects for the rich.” Thus, wealth-driven environmental destruction becomes international only through side-effects in the medium term.

Beck (1999: 36) argued that ecological destruction may promote war either as an outgrowth of resource scarcity (water) or because Western eco-fundamentalists use force to stop ongoing destruction. Such ecological destruction may trigger mass emigration which may lead to war. This may result in a spiral of destruction where different crisis phenomena converge. In the world risk society, these

‘global threats’ have together led to a world where the basis of established risk-logic has whittled away, and where hard to manage dangers prevail instead of quantifiable risks. The new dangers are removing the conventional pillars of safety calculation. Damage loses its spatio-temporal limits and becomes global and lasting. It is hardly possible any more to blame definite individuals for such damage. ... Often, too, financial compensation cannot be awarded for the damage done; it has no meaning to insure oneself against the worst-case effects of spiralling global threats (Beck 1999: 36).

The analysis of risk has become an objective of many disciplines. While the calculation of risk as a function of the probability that an event becomes real is a task of the natural science, of medicine and applied mathematics, the response of human beings to risky situations is an area for psychology, anthropology and the social sciences and how organizations and whole societies regulate risks is being analysed by political science, sociology and of law departments (Renn/Schweizer/Dreyer/Klinke 2007: 13).

These authors distinguished among seven scientific risk concepts of: 1) of the expected risk (tool: statistics; application: insurance companies); 2) risk assessment (tool: modelled risk expectance in toxicology and epidemiology; application: health, environmental protection); 3) probabilistic risk assessment (tool: event, error tree analysis; application: se-

curity analysis); 4) economic risks (tool: portfolio analysis; application: preparation of decisions); 5) risk perception (tool: psychometric experiments); 6) social risk assessment (tool: group surveys, structural analysis); 7) culture and risk assessment (tool: network analysis). The likely application of the last three risk concepts is as risk policy and regulation, conflict management, risk communication (Renn/Schweizer/Dreyer/Klinke 2007: 25; Renn 2008: 15). Renn (2008: 24–40) further distinguished among seven “social science-based theoretical approaches to risk”:

1. the *rational choice approach* (Renn/Schrimpf/Büttner/Carius/Köberle/Oppermann/Schneider/Zöller 1999; Renn/Sirling/Müller-Herold/Fisher/Dreyer/Losert/Klinke/Morisini/van Zwanenberg 2003; Jaeger/Renn/Rosa/Webler 2001);
2. the *reflexive modernization approach* by Beck (1986, 1992) and Giddens (1991, 2000);
3. the *systems theory approach* of Luhmann (1986, 1989, 1993);
4. the *critical theory approach* based on Habermas (1984, 1987);
5. the *post-modern perspective* introduced by Foucault (1982) and further developed by Ewald (1986), Burchell, Gordon, Miller (1991) and Dean (1999);
6. a *cultural theory approach*, originally introduced by Douglas (1966, 1985) and Douglas and Wildavsky (1982), recently re-presented by Adams (1995) and Lupton and Tulloch (2002);
7. the framework of the *social amplification of risk* as an example of an integrative framework that promises to link psychological, social and cultural risk theories (Kasperson/Renn/Slovic/Kasperson/Emani 1988; Kasperson/Kasperson/Pidgeon/Slovic 2003; Renn/Webler 1992; Breakwell 2007).

Since the mid 1990’s, the concept of ‘risk society’ (Beck 1986, 1992) and ‘world risk society’ (Beck 1999, 2007, preface essay) also became a new concept in political science and in international relations (M.G. Schmidt 1995, 2004). Beck’s concept of risk society has also triggered a debate on ‘risk policy’ in political science.

2.5.5 From Security and Defence Policy to the Management of Political Risks

In security policy (Brauch chap. 12) and in national and *international security studies* (ISS) in the post-Cold War era the management of global risks has become a major security task arguing “that risk rather

than security captured the nature of the post-Cold War era (Rasmussen 2001b, 2004; Beck 2002; Coker 2002; Griner 2002; Heng 2002, 2006; M.J. Williams 2008)" (Buzan/Hansen 2009: 250). By focusing both on 'every day risk management' and on catastrophic risks, Buzan and Hansen (2009: 205-251) argued that risk analysis was a topic of ISS before the events of 11 September 2001, but since then many risk theorists argued that risk analysis was better suited for dealing with issues of terrorism and migration.

Furio Cerutti (2007: 27) raised the question whether the two major global challenges of nuclear war and global warming are risks whereby he defined risk "as a function, that is, the product of the probability and size of loss", where risk is understood as risk-taking and where the selection of damage is culturally determined. Facing risks implies two kinds of uncertainty: "one regards the probability of a loss, the other our evaluation of its size and significance" (Cerutti 2007: 28).

Cass R. Sunstein (2007: 9) pointed to uncertainties in specifying the probabilities of a worst-case scenario of a dangerous climate change. In comparing the two major security dangers posed by terrorism and climate change, Sunstein (2007: 53) pointed to a specific risk perception of many Americans, for whom "the idea of terrorism conjures up intense images of disaster, as the idea of climate change does not". For Kahan and Braman (2006) and Slovic (2000) these different risk-related judgements are a product of a 'cultural cognition' or of cultural orientations that may help to explain "public reactions to numerous risks, including those associated with climate change" (Sunstein 2007: 66-67).

Henry N. Pollack (2003: 6) addressed the ambivalence between uncertainty in science and risk-taking that is referred to in "many cultures as an attribute of a successful person. But risk arises precisely because of uncertainty. The willingness and the ability to formulate and take action and accept risk in the face of uncertainty is considered a character strength. ... An unwillingness to be motivated by uncertainty is indeed a real barrier to progress." But he also noted that "science can never produce absolute certainty, and definitely not on a schedule" (Pollack 2003: 213). With regard to the tipping points in the climate system, Pollack (2003: 232) acknowledged that "climate scientists do not yet know how to identify the thresholds for such events, and the uncertainties remain formidable".

The *Millennium Ecosystem Assessment* (MA 2005: 193-195) noted the problems in dealing with

risk and uncertainties that are inherent in all human activity and cannot totally be eliminated. Ecological risk assessment has many tools and a large "potential for informing the decision process" by providing 1) analysis and a knowledge base for supporting sound decisions; 2) deliberation based on a consultation process and stakeholder involvement; 3) and relying increasingly on the precautionary principle.

A group of German scholars at the Free University of Berlin developed a new concept of 'international risk policy' for dealing with the new dangers in international relations, such as nuclear proliferation and terrorism, as well as the soft security challenges of migration, climate change, computer crime, drug trafficking and dealing with financial markets. Daase (2002: 9-35) argued that these new dangers require a paradigmatic change in security policy from defence against threats to crisis prevention. He distinguished between risks due to transformation and globalization and new political and international risks. Since 1990, the traditional threat triangle of an actor, his intentions and capabilities, has been replaced with different dangers that are often indirect, non-intended and uncertain. The fundamental difference between security threats and risks, in his view, has been that the certainty of expectation has disappeared with the departure of a clearly defined threat. Instead of reacting to perceived security threats, a proactive security policy should focus on the prevention of the causes and effects of risks. This would lead to four ideal-type strategies of international risk policy that may be described as cooperation, intervention, compensation and preparation to contain risks.

The goal of the first strategy is to reduce the probability of risks becoming reality by reducing misperceptions and by fostering a cooperative risk management;¹⁶ the second intends reducing the probability of a future damage occurring by using political and military coercion; the third aims at a cooperative reduction of the level of the probable future damage by risk sharing strategies; and finally, the fourth strategy aims at a repressive reduction of the level of probable future damage by an efficient use of political, economic, legal and military measures that try to prevent

16 Such a strategy may lead to the creation of new institutions, e.g. of the crisis prevention centre of the OSCE, or to the adaptation of existing institutions to new tasks, e.g. of NATO. The task of scientific efforts is to review the methods and procedures of risk assessment (e.g. of prognoses, projections, estimates of probabilities) to point to shortcomings and to proposed alternative procedures (Daase 2002: 19).

follow-on damages. He distinguished economic, psychological, technical, and sociological approaches for dealing with risks. This paradigm was applied in several case studies on non-proliferation, migration, climate change, terrorism, drug trafficking, computer crimes and financial markets – but none on hazards. These studies focused on risk perception, risk policy, and a risk paradox.

Daase, Feske and Peters (2002: 267–276) concluded on risk perception that while material factors played a role in the perception of dangers, socio-cultural factors determined the different risk perceptions of states. Risk perception is not stable and it may change during a political process or as a result of scientific discourses. Risk perception is a process. It is an important but not the only factor for the explanation of risk policy. To justify proactive political action the danger is often oversold, a threat is being created and several risks are combined.

2.5.6 ‘Reflexive Security’ and ‘Risk Society’ as Key Concepts of Security Studies

The sociologists Giddens and Beck have stimulated in parts of the international relations research community a debate on ‘ontological security’ (Giddens 1991; Huymans 1998; Mc Sweeney 1999; Mitzen 2005) as well as an emerging debate on ‘reflexive security’. Rasmussen (2004: 381–395) outlined a research programme on ‘reflexive security’ by applying Beck’s ‘risk society’ to security studies. While during the Cold War the balance of power and deterrence theory constituted an expert system with its own rationality and bureaucracy, since 1990 and especially 2001 they were challenged by new non-state actors, new military technologies and terrorists who “fight for values other than those of national interests”. Rasmussen asks whether the transatlantic debate focuses more on different means than on goals, or on the scale, degrees and urgency of risks.

‘Risk society’ is one way to explain what is missing in the debate between soft and hard security. The point is not on how to apply the concept of security, but that the concept of security itself is changing. Surveying the history of the concept of security from the Romans to the present, Ole Wæver (2002) thus argues that today’s considerations of safety are increasingly about managing risks rather than achieving perfect security. The focus on risk society turns the ‘broad conception of security’ inside out. It is not only the case that security policy needs to take many more issues into consideration, it is argued, but along with the many other policy areas, the way security issues

are being handled politically is being transformed (Rasmussen 2004: 388–389).

Rasmussen (2004: 389–395) proposes to apply the sociological theories of reflexive modernity to “reflexive security studies”¹⁷ and to translate the empirical findings back to sociological theory.¹⁸ However, the social science debate on the concepts of ‘risk’ and ‘risk society’ was largely detached from the specific issues addressed in the environment and hazard communities to which we turn next. While some authors of international security studies argued that

risk rather than security captured the nature of the post-Cold War era (Rasmussen [2001a, 2001b, 2002], 2004, [2006]; Beck 2002; Coker 2002; Griner 2002; Heng 2002, 2006; M.J. Williams 2008). ... Risk analysis had been brought into ISS prior to 9/11, but the surprise attack on 9/11 as well as the utility of ‘everyday risk management’ to identify the enactment of anti-terrorism and anti-migration policies made risk theorists hold that they offered a better account of security and terrorism (Buzan/Hansen 2009: 250).

Buzan and Hansen argued that the risk literature is an inherent part of ISS while many traditional American reviews of security studies have ignored the discourse

17 Rasmussen (2004) has mapped “the current achievements and future challenges of this emerging research programme on risk arguing that it offers a way to overcome the debate about whether to apply a ‘broad’ or ‘narrow’ concept of security; a debate which is stifling the discipline’s ability to appreciate the ‘war on terrorism’ as an example of a new security practice. Discussing the nature of strategy in a risk environment, the paper outlines the consequences for applying the concept of reflexive rationality to strategy”. See also: Shlomo Griner (2002).

18 Rasmussen (2004: 389–395) identified three research themes on: 1. globalization; 2. region and individual level of non-state actors; and 3. study of specific strategies. He argues that reflexive security studies that make conceptual change an empirical matter “offer one possibility for taking account of the transformation of practice”. This requires a clear definition of this scope: “Are reflexive security studies about certain ‘risky’ policy areas or has it something to say about the entire security agenda?” He argues that the polarized debate on the policy response to 9/11 illustrates “one of the basic facts of life in reflexive modernity: that the way by which we try to solve problems ... become a ‘theme and a problem itself.” He points to a need “to develop a shared discourse on how to manage risks that takes account of strategic necessities, as well as concerns of world order, legitimacy and human rights. ... It highlights the need for security studies to catch up with the present practices of security policy and help develop a vocabulary that enables a reflexive debate on security priorities in the future”.

provoked by Beck. In *The Politics of Climate Change* Anthony Giddens (2009: 7) argued that “climate change politics is all about risk and how to manage it” and that “the long-term thinking needed to counter climate change has to operate against the backdrop of uncertainty”. To develop such a forward looking politics of climate change, Giddens (2009: 8) suggested several new concepts that of the “ensuring state” that acts as a “facilitator, an enabler” and “political and economic convergence”.

The first refers to how far climate change policy overlaps in a positive way with other values and political goals. Political convergence is crucial to how far climate change policy becomes innovative and energetic, but also to whether it receives widespread support. ... In the developed countries, we can no longer equate progress with economic growth. ... Economic convergence concerns how far economic and technological innovations that are developed to combat global warming also generate competitive advantage to those who deploy them (Giddens 2009: 8–9).

Giddens calls for “a positive model for a low-carbon future” that requires a transition strategy towards sustainable development (Grin/Rotmanns/Schot 2010) that should aim at a “Fourth Green Revolution” (chap. 95 by Oswald Spring/Brauch). In moving towards that end, Giddens’s (2009: 12–13) advice to policy-makers is:

1. Promote political and economic convergence wherever possible and do so in an active way. ...
2. Look first and foremost to embed a concern with climate change to people’s everyday lives, while recognizing the formidable problems involved in doing so. ...
3. Avoid making political capital out of global warming. ...
4. Set up detailed risk assessment procedures, stretching into the long run, since the implications of climate change policy are complex. We have to construct a future in which renewable sources will comprise the bulk of energy use. It will be a far-reaching transition indeed, with a whole raft of complex social and economic effects.

In conclusion, Giddens (2009: 229–230) argues that “coping with climate change could be a springboard for creating a more cooperative world. It might be a means of reinvigorating the UN and other institutions of global governance”. But he cautioned that “all governments face deep dilemmas in reconciling climate change with energy policy with sustaining popular support, especially in times of economic difficulty”. However, “technological innovation is one of the several major jokers in the pack”, where a quantum leap

is needed to move humankind towards a new enlightenment and to avoid new Dark Ages.

This requires from the social sciences conceptual contributions to develop strategies for an ecological transition (Grin/Rotmanns/Schot 2010) to cope with the projected impacts of climate change during the 21st century with a complex set of adaptation and mitigation measures. Toward that end, Nair, Tanner and Bhadwal (2009: 399ff.) in a study by TERI, IISD and CICERO suggested a “climate risk screening” with an “evaluation of adaptation to climate change” that includes a portfolio screening using the ORCHID (*Opportunities and Risks of Climate Change and Disasters* process) methodology (chap. 64 by Nair).

Finally, from an economic perspective, Nicholas Stern (2009: 12) suggested to include ethical considerations in the long-term thinking on “how to reduce risks for future generations”. Given the lack of knowledge, “policy on climate change involve decision-making under risk and uncertainty” (Stern 2009: 16–19), where ‘risk’ refers to an estimated probability and ‘uncertainty’ to the impossibility to make educated guesses on the probability. But besides risks, Stern (2009: 135) refers to the many economic opportunities due to the “transformation of energy systems from high- to low-carbon” that creates “new, multibillion-dollar markets, which are now attracting significant capital”.

2.5.7 Global and Regional Environmental Risk as a Scientific Concept

In security and environment policy, the risk concept is sometimes used without a clear delineation from the other concepts of threats and challenges. From an environmental perspective, Kasperson and Kasperson (2001: 1) tried to combine all four basic concepts: “global environmental *risk* is about *threat*; it is also about opportunity”. The goal of their book is to take stock of “distinctive *challenges* posed by global environmental *risks*, the ability of the knowledge system to identify and characterize such *threats*, and the capability of societies to address the management of *challenges*” (emphasis added).

They distinguish between *systemic* risks (e.g. of global warming) and *cumulative environmental change* that may cause both short- and long-term consequences. They used risk synonymously with hazard, referring to “human beings and what they value”. For them, *global environmental risk* “refers to threats ... resulting from human-induced environmental change, either systemic or cumulative, on the global scale”.

They focus on five themes: 1) Global environment *risk* is the ultimate *threat*. 2) *Uncertainty* is a persistent feature both of understanding process and causation as well as predicting outcomes. 3) Global environment risk manifests itself in different ways at different spatial scale. 4) *Vulnerability* is a function of variability and distribution in physical and socio-economic systems, the limited human ability to cope with additional and sometimes accumulating hazard, and the social and economic constraints that limit these abilities. 5) Futures are not given, they must be negotiated.

The authors claim that global environmental risks “threaten international security and peaceful relations among states” contributing to differentiation of wealth and “increasing competition, tensions, and conflict”. They refer to five risk sources: a) disputes arising from human-induced local environmental degradation; b) ethnic clashes arising from population migration and deepened social cleavage due to environmental scarcity; c) civil strife caused by environmental scarcity that affects economic productivity and, in turn, people’s livelihoods, elite groups, and the ability of states to meet changing demands; d) scarcity-induced interstate war over, for example, water¹⁹; and e) North-South conflicts over mitigation of, adaptation to, and compensation for global environmental problems (Homer-Dixon 1999: 5). On the environmental security debate they admit “that such frameworks and models remain very limited in providing satisfactory interpretations” and that “causal linkages between environmental change and attributes of environmental security are yet poorly defined and understood”.

Kasperson, Kasperson, Turner, Dow and Meyer (1995: 5–8) distinguished between *geocentric* and *anthropocentric* approaches to the study of environmental criticality which they defined as “a state of both environmental degradation and associated socio-economic deterioration”. A *critical region* refers to “an area that has reached such a state of interactive degradation”. The *geocentric* approach defines criticality “in terms of changes in physical attributes or social dimensions” due to human-induced perturbations that have altered the biophysical system. While the *geocentric* approach focuses purely on the physical envi-

ronment, the *anthropocentric perspective* focuses solely on human inhabitants. Therefore, the authors suggest an integrative, holistic approach to the criticality of environmental threats which they describe with the conflicting terms – sensitivity, resistance, resilience, marginality, fragility, and vulnerability. Any analysis of criticality requires an assessment of what and who is threatened by environmental degradation. From the literature and their discussion they drew several lessons for the study of ‘environmental criticality’ of relevance for a regional approach:

Human-environment trajectories appear particularly likely to lead to criticality in situations that have some combination of:

- economies of high sensitivity and low resilience to environmental change;
- human societies with high social and economic vulnerability;
- economies strongly dependent upon local environmental resources;
- frontier areas exposed to new forms of use; and
- close linkage with, and dependent position *vis-à-vis*, global markets or distant political authority (Kasperson/Kasperson/Turner/Dow/Meyer 1995: 22–23).

Non-linear environmental change may exacerbate societal diagnosis and delay responses. Criticality refers to situations where emerging environmental degradation may lead to a loss of a capability to survive. The ‘critical region’ concept does not adequately capture the identifiable situations, rather additional categories are needed. A lot of the change inflicted by human pressures on the environment may impose costs on future generations that must be included in approaches to endangerment and criticality. But many of the currently perceived environmental threats may disappear in the near future. These authors differentiate “criticality” from lesser degrees of environmental threats such as environmental endangerment and impoverishment. The ‘critical regions’ are characterized by *environmental degradation* (water, air, soil, biomass productivity), *wealth* (GNP, income, savings), *well-being* (longevity, mortality, infant mortality, nutrition, environmentally induced disease) and *economic and technological substitutability* (cash-crop dependency, technological monocultures, innovation, economic diversity). Before a region reaches a status of environmental criticality, many warning signals alert experts and the society to impending or recurring damage. The degree of response depends largely on the political and societal sensitivity but also on the resources available to cope with these challenges.

19 While both international officials and national policymakers, journalists and defence officials have used the water war argument, this hypothesis has been disputed by many recent scientific publications in the social sciences (e.g. Wolf 2002; WWAP 2003; Kipping/Lindemann 2005).

Based on nine case studies they concluded that a) external factors were more important than internal ones; and b) state policy and institutions were key factors of change while the $I = PAT$ formula (*Impact = population - affluence - technology*) was criticized for overstressing affluence and neglecting poverty. In most third world cases “poverty rather than affluence has driven unsustainable resource use”. On the regional level, they pointed to “three aspects of environmental and socio-economic conditions [that] suggest an increasing potential for higher or catastrophic losses: 1. *Vulnerability and overshoot ... 2. market conditions and overcapitalization...* [and] 3. *loss of options and safety nets*” (Turner/Kasperson/Kasperson/Dow/Meyer 1995: 560). They discussed different societal responses, symptoms of emerging criticality, spatial and temporal categories. Contrary to global environmental change, the trajectories of change

in these threatened areas provide a warning, ... that supplements those recent discoveries ... at the global scale. In nearly all these regions, trajectories of change are proceeding to greater endangerment, ... while societal efforts to stabilize these trajectories and to avert further environmental deterioration are lagging and are generally only ameliorating the damage rather than intercepting the basic human driving forces of change. ... The trajectories of change in most ... regions are rapidly outstripping societal responses. ... The future populations ... are being environmentally impoverished by these trends. ... The trajectories suggest growing long-term costs of regional substitution, adaptation, and remedial measures. ... In the future, these trends will also eclipse regional societal capabilities to respond (Turner/Kasperson/Kasperson/Dow/Meyer 1995: 580).

They noted a rich variety of human causation and they argued that no single dominant human driving force can explain “the historical emergence of environmental degradation”, nor could the *grand theories* offer satisfying interpretations. They conclude that “the regional dynamics of change - the interplay among the trends of environmental change, vulnerabilities and fragility, human driving forces, and societal responses - must be examined within their cultural, economic, and ecological contexts”. For them “the most satisfying interpretations ... recognize the shifting complexes of driving forces and responses over time, tap diverse social science theory, and are firmly grounded in ... empirical work”. The regional trajectories of change and associated regional dynamics must be analysed in the broader framework of extra-regional linkages, such as processes of economic globalization, including trade policies in the WTO framework that have a major environmental impact.

In conclusion, Turner, Kasperson, Kasperson, Dow and Meyer (1995: 582–583) suggest a regional tailoring of global initiatives:

The regional dynamics of change ... reveal a recurring disjuncture between the fast rate of environmental change and the slow pace of societal response. ... The global scale reveals a much more mixed picture where societal responses to such changes as stratospheric ozone depletion, global warming, and industrial accidents have often been quite rapid, if less than totally effective. Still, signals of environmental threat have been processed with considerable speed and coping actions undertaken. But the trajectories of change ... provide considerable confirmation of the argument of overshoot ... by Donella Meadows and her colleagues (1972, 1992).

This debate on risk in the environmental research community has been developed further with a slightly different focus in the international scientific and political hazard community.

2.5.8 Risk as a Scientific Concept in the Hazard Community

A major area of the debate on risks in many scientific disciplines have been natural, human-induced natural, man-made hazards, technical calamities and manifold disasters or catastrophes that have focused on problems of ‘risk perception’, ‘risk analysis’, ‘risk assessment’ and ‘risk management’. Slovic (2000) summarized the results of a research team that examined “the gap between expert views of risk and public perceptions”, how these perceptions have evolved and changed over time, increasingly recognizing “the importance and legitimacy of equity, trust, power and other value-laden issues underlying public concern”. They described “new methods for assessing perceptions of risk” and they discussed “the implications for regulation and public policy”. In a follow-up study Pidgeon, Kasperson and Slovic (2003) analysed “how both social and individual factors act to amplify or dampen perceptions of risk and through this created secondary effects such as stigmatization of technologies, economic losses, or regulatory impacts”. They focus on “risk perception and communication” and draw lessons “for public policy, risk management, and risk communication practice”.

Posner (2004) offers an interdisciplinary perspective that combines the insights of a lawyer, a social and physical scientist in weighing risks and possible responses to a major catastrophe such as global warming, bioterrorism or a major accident. He argues that the risks of global catastrophe have grown due to the

technological advance and industrial applications, the growth of the world economy and population, and the rise of apocalyptic global terrorism that are often underestimated due to low probability that they may happen in the near future. However, there is a difference in public attention and response between creeping natural disasters (climate change) and intended catastrophes, such as nuclear attacks, bioterrorism, and cyber terrorism that have become an objective of the military and of criminal justice. Posner calls for a mutual rethinking of the liberals “in the face of technological terrorism” and of the conservatives on global warming, many of them deny that these global challenges and risks require a global response based on international cooperation.

Blaikie, Cannon, Davis and Wisner (1994) as well as Wisner, Blaikie, Cannon and Davis (2004)²⁰ offered a comprehensive theoretical framework on the challenges of disasters, on disaster pressure and release models, and access to resources and coping in adversity as well as an empirical analysis of famine and natural hazards, biological hazards, floods, coastal storms, earthquakes, volcanoes and landslides and on action for disaster reduction. They look for “the connections between the risks people face and the reasons for their *vulnerability* to hazards”. For them disasters “are not only natural events that cause them. They are also the product of the social, political, and economic environment ... because of the way it structures the lives of different groups of people”. Many disasters are a complex mix “of natural hazards and human action”. In their definition:

A disaster occurs when a significant number of vulnerable people experience a hazard and suffer severe damage and/or disruption of their livelihood system in such a way that recovery is unlikely without external aid. By recovery we mean the psychological and physical recovery of the victims, the replacement of physical resources and the social relations required to use them (Blaikie/Cannon/Davis/Wisner 1994: 21).

To understand risk in terms of their vulnerability analysis, they use two models of disaster: a) a *pressure and release* model (PAR), and b) an access model that

relates to both *human vulnerability* and *exposure* to physical hazard. In the PAR model they distinguish three stages of vulnerability: a) the *root causes* (access to power, structure, resources; ideologies, political and economic systems); b) *dynamic pressures* (lack of local institutions, training, skills, local investment and markets, press freedom; macro forces: population growth, urbanization, arms expenditure, debt repayment, deforestation, decline in soil productivity); and c) *unsafe conditions* (fragile physical environment: dangerous location, unprotected buildings, infrastructures; fragile local economy: livelihoods at risk, low income levels; vulnerable society: special groups at risk, lack of local institutions; public actions: lack of disaster preparedness, prevalence of endemic disease). They refer to hazards of a *biological* (virus, pest), *geophysical* (earthquake, volcano) or *hydro-meteorological* (storms, floods, drought) nature. They defined risk as hazard + vulnerability ($R=H+V$). Thus, vulnerability refers to “unsafe conditions”.

Wisner, Blaikie, Cannon and Davis (2004: 10) differed from the conventional approach to disasters that in their view stressed “the ‘trigger’ role of geotectonics, climate or biological factors arising in nature (... Bryant 1991; Alexander 1993; Tobin/Montz 1997; K. Smith 2001)”. They argued that other authors “focus on the human response, psychosocial and physical trauma, economic, legal and political consequences (Dynes/DeMarchi/Pelanda 1987; Lindell/Perry 1992; Oliver-Smith 1996; Platt 1999)”. Both approaches from the natural and from the social sciences “assume that disasters are departures from ‘normal’ social functioning, and that recovery means a return to normal”. Wisner, Blaikie, Cannon and Davis (2004: 10) do

not deny the significance of natural hazards as trigger events, but [their book] puts the main emphasis on the various ways in which social systems operate to generate disasters by making people vulnerable. In the 1970’s and early 1980’s, the vulnerability approach to disasters began with a rejection of the assumption that disasters are ‘caused’ in any simple way by external natural events, and a revision of the assumption that disasters are ‘normal’. Emel and Peet (1989), Oliver-Smith (1986) and Hewitt (1983a) review these reflections on causality and ‘normality’. A competing vulnerability framework arose from the experience of research in situations where ‘normal’ daily life was itself difficult to distinguish from disaster. This work related to earlier notions of ‘marginality’.

To overcome the separation of the hazard from the social system (figure 2.1), they have developed a second access model that focuses on “the way unsafe conditions arise in relation to the economic and polit-

20 Parts of the revised second edition are available at: <<http://www.unisdr.org/eng/library/Literature/7235.pdf>>. In the introduction the authors discuss more recent literature on the basic idea and some variations, on Beck’s theory of risk society, on various deconstruction approaches as well as on vulnerability and normal, daily life. Wisner, Blaikie, Cannon and Davis (2004: 8) outlined their approach in a figure on the social causation of disasters.

ical process that allocates the assets, income, and other resources in a society” (Blaikie/Cannon/Davis/Wisner 1994: 46) and to include “nature in the explanation of hazard impacts”. For them vulnerability is a hypothetical term “which can only be ‘proved’ by observing the impact of the event when, and if, it occurs. By constructing the household access model for the affected people we can understand the causes and symptoms of vulnerability” (Blaikie/Cannon/Davis/Wisner 1994: 58).

In the second edition, Wisner, Blaikie, Cannon and Davis (2004: 13-) referred to four new streams of thought on vulnerability (e.g. by Wilches-Chaux 1992; Jeggle/Stephenson 1994; Davis 1994; Buckle 1998/99; Buckle/Marsh/Smale 2000; Currey 2002) since the early 1990’s: a) emphasizing the people’s ‘capacity’ to protect themselves rather than just the ‘vulnerability’ that limits them (Hewitt 1997: 167); b) quantifying vulnerability as a tool of planning and policy-making (Gupta/Kakhandiki/Davidson 1996; Davidson/Gupta/Kakhandiki/Shah 1997; Davidson/Villacis/Cardona/Tucker 2000; Hill/Cutter 2001; UNDP 2003; Gheorghie 2003); c) pointing to the cultural, psychosocial and subjective impacts of disasters (Rosa 1998; Perry/Mushkatel 1986; Oliver-Smith/Hoffman 1999; Johns 1999; Tuan 1979); and d) shifting from ‘vulnerable groups’ to a concern with ‘vulnerable situations’ (Harding 2001).

In the first edition they distinguish several types of coping strategies: a) preventive strategies; b) impact-minimizing strategies; c) creation and maintenance of labour power; d) building up stores of food and saleable assets; e) diversification of the production strategy; f) diversification of income sources; g) development of social support networks; and h) post-event coping strategies.

To release the pressures contributing to vulnerability and thus to reduce disasters, Blaikie, Cannon, Davis and Wisner (1994) suggest to address the root causes, to reduce pressure, and to achieve safe conditions aiming at: no loss of life, no casualties, restricted damage and food security, and to reduce hazards by improved flood control, shelter breaks, etc. The management of vulnerability reduction should follow 12 principles: 1. vigorously manage mitigation; 2. integrate the elements of mitigation; 3. capitalize on a disaster to initiate or develop mitigation; 4. monitor and modify to suit new conditions; 5. focus attention on protection of the most vulnerable; and 6. on lives and livelihoods of the vulnerable; 7. on active rather than passive approaches; and 8. on protecting priority sectors; 9. measures must be sustainable over time; 10. as-

simulate mitigation into normal practices; 11. incorporate mitigation into specific development projects; and 12. maintain political commitment. They propose efforts “towards sustainable reduction of disasters”.

In the second edition, Wisner, Blaikie, Cannon and Davis (2004: 20-35) pointed to new developments in disaster research reflecting the theoretical, practical and institutional work in the framework of the United Nations’ *International Decade for Natural Disaster Reduction* (IDNDR, 1990-1999), with a special focus on: a) urban growth and urban concerns; b) changes in earth care, of the climate change negotiations and lessons learned from wildfires, tropical storms, floods and landslides; c) the emergence of the ‘precautionary principle’; d) critiques of globalization; e) changes in human development and well-being; f) war and humanitarian relief; g) media and policy selectivity.

In Chinese, the word risk combines the characters meaning ‘opportunity’ and ‘danger’ what implies that risks cannot be eliminated but only managed. From a hazard perspective, Smith (³2001: 14) defined risk as:

the actual exposure of something of human value to a hazard and is often regarded as the product of probability and loss. Thus we may define hazard (or cause) as ‘a potential threat to humans and their welfare’ and risk (or consequences) as ‘the probability of a hazard occurring and creating loss’. ... An earthquake hazard can exist in an uninhabited region but an earthquake risk can occur only in an area where people and their possessions exist. Clearly, both hazard and risk can be increased and reduced by human actions.

For Smith (2001: 55) *risk management* “means reducing the threats posed by known hazards, whilst simultaneously accepting unmanageable risks, and maximizing any related benefits”. *Risk assessment* “involves evaluating the significance of a risk, either quantitatively or qualitatively”. He conceptualizes: $risk = hazard (probability) \times loss (expected) : preparedness (loss mitigation)$. Both risk assessment and management depend on value judgments that are conditioned by beliefs and circumstances. Perceived risks are often distinguished as 1. *involuntary risks* (in a hazard prone environment); and 2. *voluntary risks* (more susceptible to control). Based on Kates and Kasperson (1983) for Smith (2001: 59) risk assessment comprises three steps:

- 1 The identification of local hazards likely to result in disasters, what hazardous events may occur?
- 2 The estimation of the risks of such events, that is, what is the probability of each event?

- 3 The evaluation of the social consequences of the derived risk, that is, what is the likely loss created by each event?

Risk is thus defined as the product of probability and loss: $R = p \times L$. While risk assessment depends on expert assessments, risk perception depends on an individual's intuition, estimation and evaluation. It may be determinate, dissonant or probabilistic.

From a natural hazard perspective Tobin and Montz (1997: 281-283) defined risks as a part of hazard but both are not synonymous.

Risk is an important component of hazard analysis and risk analysis forms an important subdivision of the study of natural hazards. ... Frequently risk is seen as the product of some probability of occurrence and expected loss. ... To get a better assessment of hazard risk, details of vulnerability must be incorporated in the analysis. Statistically, this relationship can be expressed as:

Risk = probability of occurrence x vulnerability.

This formula ... fails to incorporate geographic differences in population size and density (or ... exposure) as well as communal adjustments undertaken to minimize loss. Mitchell (1990) conceptualizes hazards as a multiplicative function of risk, exposure, vulnerability, and response:

Hazard = f (risk x exposure x vulnerability x response) where

risk = the probability of an adverse effect

exposure = the size and characteristics of the at-risk population

vulnerability = the potential for loss

response = the extent to which mitigation measures are in place.

Just as risk is only one component of hazards.... It comprises two elements that must be considered separately and together. These are (1) a choice of action and (2) an outcome, which includes a probability of occurrence and a consequence (or magnitude).

For Tobin and Montz (1997: 331-332) a combination of physical characteristics and political factors defines risks. "By contrast, vulnerability is determined by all the elements in various combinations; this suggests that if we alter one of the elements, we have altered vulnerability. ... Risk and vulnerability are a part of the context, and they are changed when any one element in any of the three categories is changed." This is crucial for hazard mitigation efforts that focus on reducing exposure, risk, economic losses and death as well as stress. Structural changes in society can reduce vulnerability and thus impact on reducing economic losses, death and stress. The above quotes indicate

that within the natural hazard community no consensus exists on the definition of the risk concept. This definition has been used in several studies by the 'GRAVITY team' of UNEP/DEW/GRID and by the UNDP/BCPR Report on *Reducing Disaster Risk* (2004).

2.5.9 Risk as a Practical Concept in the Hazard Research Community

For the practical and policy-oriented hazard community 'risk' has been the key operative concept. In July 1979, a UN expert meeting suggested a framework for the analysis of risks and natural disasters (UNDRO 1980) and in 2009, the *International Standardization Organization* (ISO) published ISO 31000 (2009) on principle and guidelines of risk management.

From an American perspective, the American Society of Civil Engineers (Haimes/Stakhiv 1989) reviewed 'risk analyses', 'risk communication decision-making', 'environmental risk analysis' and health hazards, global warming and climate change, as well as 'risk management strategies' for natural and technological hazards.²¹ The US *National Research Council* (NRC 2000) analysed the application of 'risk analysis' techniques for US institutions, especially for the US Army's Corps of Engineers, and the US *Federal Emergency Management Agency* (FEMA).²² Risk analysis should deal with temporal and spatial natural variability, knowledge uncertainty (parameters, models), and decision model uncertainty (time preferences, values, objectives). Based on a review of global disaster reduction initiatives, UN-ISDR (2002: 24) defined 'risk' as:

The probability of harmful consequences, or expected loss (of lives, people injured, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable/capable conditions.

21 In the introductory chapter, W.D. Rowe (1989: 1-2) defined risk as "the downside of a gamble" [that] "implies a probability of outcome, and the gamble may be involuntary or voluntary, avoidable or unavoidable, controllable or uncontrollable. The total gamble in which risk is imbedded must be addressed if the risk is to be analyzed, both the upside (benefits) and downside."

22 The NRC Study (2000: 179) defined "risk as the probability of failure during a flood event. For reaches without levees, failure means exceeding a target stage. For reaches with levees, it means a levee failure." And residual risk as: "the portion of the flood risk that still exists with the flood damage reduction project implemented".

Conditionally risk is expressed by the equation $\text{Risk} = \text{Hazards} \times \text{Vulnerability}/\text{Capacity}$.

In the second edition (ISDR 2004, II: 6) a slightly different definition of 'risk' is offered:

Conventionally risk is expressed by the notation: $\text{Risk} = \text{Hazards} \times \text{Vulnerability}$. Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability. Beyond expressing a possibility of physical harm, it is crucial to recognize that risks are inherent or can be created or exist within social systems. It is important to consider the social contexts in which risks occur and that people therefore do not necessarily share the same perceptions of risk and their underlying causes.

ISDR (2004: II: 6) described 'risk assessment and analysis' as:

A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend. The process of conducting a risk assessment is based on a review of both the technical features of hazards such as their location, intensity, frequency and probability, and also the analysis of the physical, social, economic and environmental dimensions of vulnerability and exposure, while taking particular account of the coping capacities pertinent to the risk scenarios.

However, the social contexts are crucial in which risks occur, and thus often the perceptions of risks and of their causes differ (Nathan 2001). Accordingly, the process of risk assessment relies on a review of both technical features of hazards and of the physical, social and economic dimensions of vulnerability, reflecting the different coping capabilities. ISDR (2002: 24) defined 'risk assessment and analysis' as: "A process to determine the nature and extent of risk by analysing conditions of vulnerability/capacity that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend."

Based on Tobin and Montz (1997), Peduzzi, Dao, Herold, Rochette and Sanahuja (2001: 9-10) defined risk as "a measure of the expected losses due to hazard event of a particular magnitude occurring in a given area over a specific time period" - The GRAVITY-team focused on risks "faced by population, in terms of wounded and killed while confronted to natural disasters". This risk definition includes: "the probability of occurrence and severity of a specific hazard for a given area and length of time, the vulnerability of the population and the capacity of mitigation, this last could be introduced in the vulnerability or taken sep-

arately, depending on authors". They offer this formula of risk:

$$\text{Risk}_i = (\text{Hazard}_i - \text{Prevention}_i) \times [\text{Population} \times (\text{Vulnerability}_i - \text{Mitigation}_i)]$$

As no data were available on both preparedness and mitigation, they proposed a simplified model:

$$\text{Risk}_i = \text{Hazard}_i \times \text{Population} \times \text{Vulnerability}_i$$

Where the hazard multiplied by the population represents the physical exposure, risk is also:

$$\text{Risk} = \text{Physical exposure} \times \text{Vulnerability} \text{ or} \\ \text{Risk/Physical exposure} = \text{Vulnerability}$$

In their second report, Peduzzi, Dao and Herold (2002: 3) used the term 'risk': "to describe potential losses resulting from expected future hazard". Their research focused on human aspects (i.e. persons killed) from natural hazards, and they relied on the database of the *Centre for Research on Epidemiology of Disasters* (CRED) in Louvain, Belgium for 'killed', 'wounded', 'homeless', 'affected' and 'total affected', but due to a high variation they only used the number of persons killed as risk indicators. Based on a definition by the *United Nations Disaster Relief Coordinator* (UNDRO 1979) for them risk results from three components: "*hazard occurrence probability*, defined as the probability of occurrence of a specified natural hazard as a specified severity level in a specified future time period, *elements at risk*, an inventory of those people or artefacts which are exposed to the hazard and *vulnerability*, the degree of loss to each element should a hazard of a given severity occur" (Coburn/Spence/Pomonis 1991: 49). Peduzzi, Dao and Herold (2002: 3) proposed for modelling risk to multiply the three factors explaining risk: $\text{Risk} = \text{Hazard} \times \text{Population} \times \text{Vulnerability}$. Thus, there is no risk if no hazard exists or nobody lives in the affected area, or if the vulnerability is reduced by preparedness and mitigation measures.

In the fourth report of the GRAVITY-Team, Dao and Peduzzi (2003: 3) repeated their previous definitions and they used as risk indicators the "number of killed, percentage of killed, percentage of killed as compared to the exposed population with their respective advantages and inconveniences". The *Disaster Risk Index* (DRI) is based on a combination of the first two indicators. In a brief article, Dao and Peduzzi (2004: 2) relied on the definition of risk by UNDRO (1979) that "refers to the expected losses from a particular hazard to a specified element of risk in a particular future time period" that may occur in

terms of “human lives, or building destroyed or in financial terms”. Thus, if risk represents the losses, then “hazard can be defined as a potential threat to humans and their welfare” (Smith 1996). As extreme events, hazards “may create risk and potentially turn into disasters if the exposed elements are vulnerable”.

The UNDP Report (2004: 2): *Reducing Disaster Risk - A Challenge for Development* has applied the methodology and the DRI developed by the GRAVITY-Team of UNEP. In responding to the *Millennium Development Goals* (MDGs), the UNDP report tried to mainstream disaster reduction and developing concerns by a) a collection of basic data on disaster risk and the development of planning tools; b) collection and dissemination of best practice in development planning; and c) galvanizing of political will to reorient both the development and disaster management sectors. The initial *Disaster Risk Index* (DRI) points to three limitations by a) focusing only on the risk of death; b) examining only risks associated with large- and medium-scale disasters; and c) representing risks associated with earthquakes, tropical cyclones and floods.

2.5.10 From Yokohama to Kobe: Global Policy Goals for Natural Disaster Prevention, Preparedness, and Mitigation

Since the adoption of the *Yokohama Strategy for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation and its Plan of Action* in 1994 significant conceptual and practical policy progress has been made. The *Review of the Yokohama Strategy* (A/Conf.206/L.1) listed five major accomplishments and remaining challenges, dealing with governance, risk identification, knowledge management, reducing underlying risk factors and preparedness for effective response and recovery. Under risk identification they referred to assessment, monitoring and early warning. The review stressed a need for “greater awareness of the social and economic dimensions of vulnerability”, for improved data and analytical tools, it pointed to *emerging risks* (urban risks and exposure of complex infrastructure, greater attention to the interaction between natural and human-induced hazards (technological risks), including climate change impacts. With regard to *reducing underlying risk factors*, the review addressed (i) environmental and natural resource management; (ii) social and economic development practices; (iii) land-use planning and other technical measures; and (iv) advanced technologies (including remote sensing).

The *World Conference on Disaster Reduction* (WCDR) in Kobe (18 to 22 January 2005), in its *Hyogo Framework for Action 2005-2015* promoted “a strategic and systematic approach to reducing vulnerabilities and risks to hazards” by underscoring “the need for ... building the resilience of nations and communities to disasters” (A/Conf.206/L.2/Rev.1: 3). The final document maintained:

Disaster risk arises when hazards interact with physical, social, economic and environmental vulnerabilities. Events of hydro-meteorological origin constitute the large majority of disasters. Despite the growing understanding and acceptance of the importance of disaster risk reduction and increased disaster response capacities, disasters and in particular the management and reduction of risk continue to pose a global challenge.

At the Kobe conference, among the five main areas where gaps for action for 2005 to 2015 were identified, two dealt with “risk identification, assessment, monitoring and early warning” and with “reducing underlying risk factors”. To achieve these aims, the conference adopted three strategic goals of which the third called for “the systematic incorporation of risk reduction approaches into the design and implementation of emergency preparedness, response, recovery programmes for disaster affected communities”. The *Hyogo Framework for Action 2005-2015* proposed enhanced international cooperation and assistance in the field of disaster risk reduction, including knowledge transfer, sharing of research results, enhance governance, financial assistance to reduce existing risks and setting-up of governance systems that “can avoid the generation of new risk”. The strategy called for preventive and proactive measures (early warning efforts and systems).

In order to identify, assess and monitor disaster risk and enhance early warning, the Kobe strategy listed among the key activities: i) *National and local risk assessments* (risk maps, indicators of disaster risk and vulnerability); ii) *early warning* (people-centred, information systems, institutional capacities, better cooperation); iii) *capacity* (support for infrastructures, databases, support for methods and capacities); and iv) *regional and emerging risks* (cooperation, early warning, research on long-term changes: climate trends, diseases, land-use, environmental hotspots, slope deforestation, demographic changes and density, rapid urbanization, relevant trade factors). For reducing underlying risk factors, the document has referred to: i) *environmental and natural resource management*; ii) *social and economic development*

practices; and iii) *land-use planning and other technical measures*.

On a regional European level, the Commission of the European Communities, in its “Strategic Objectives 2005–2009 – Europe 2010: A Partnership for European Renewal: Prosperity, Solidarity and Security” (26 January 2005) stated that the security of the citizen “can be put at risk by natural disasters, environmental or health crises and transport and energy threats”. The President of the Commission stated that “the Union has a role to play at all stages: risk prevention, early warning, crisis management, and acting in solidarity with the victims of disasters”. One of the five key security themes will be: “managing risk in the modern world”. The Commission documents as the first of three tasks:

Environmental and health risks such as the increased threats of floods or droughts following climate change, the fallout from potential biological, chemical or radiological attacks of serious outbreaks of disease have immediate EU-wide implications. They must be tackled in two ways: by the ability to offer early warning and immediate response to a particular crisis, and by long-term prevention. Information and surveillance networks need to be effective if they are to cope adequately with cross-border threats.

With regard to “Europe as a world partner”, the strategic objectives of the European Commission called for: 1) a stronger actor in the world economy; 2) global solidarity; and 3) making security work worldwide to enable Europe “to tackle stability and security issues at their root by strongly promoting sustainable development through both multilateral and bilateral channels”.

The security part of the EU Commission’s “Strategic Objectives” reflected the debate on reconceptualization of security by shifting the focus from narrow military threats to: a) non-military security challenges for justice and home affairs (to counter crime, terrorism, human and drug trafficking); b) natural disasters, environmental and health risks; c) energy supply crises and vulnerability of traffic and energy infrastructure; and d) promoting global solidarity with sustainable development.

These declaratory policy goals of the UN’s *Hyogo Declaration* and the EU’s *Strategic Objectives* reflect both a reconceptualization and a redefinition of security ‘threats’, ‘challenges’, ‘vulnerabilities’ and ‘risks’ with an application to natural hazards. In 2005, the Hyogo Framework for Action 2005–2015 requested the UNISDR secretariat to “update and widely disseminate international standard terminology related to disaster risk reduction”. In the 2009 version, the

terms were revised and are now defined by a single sentence (table 2.1).²³

These adopted definitions apply to the risk related activities of many international organizations and they are also used by many governments for guidance.

2.6 Environmental Security Threats, Challenges, Vulnerabilities and Risks

The contextual change since 1990 and the scientific changes in several disciplines have contributed to a widening and a deepening of ‘security’ and accordingly the related concepts of security threats, challenges, vulnerabilities and risks have also changed. Since 1989 a debate has evolved on the ‘environmental security dimension’ and on ‘environmental’ or ‘ecological’ threats, challenges, vulnerabilities and risks for national, international and human security.

2.6.1 The Environment as New ‘Threats’ to National Security

The scientific debate on environmental security started at the end of the Cold War. Westing (1988: 257–264) pointed to both the military impact on the environment and to environmental factors of security, such as territorial, shared or extra-territorial resources that require mechanisms for the non-violent resolution of resource conflicts. The former Norwegian Foreign Minister Holst (1989: 123–128) saw a triple relationship between conflict and environment: a) *environmental deterioration* (space, atmosphere, lithosphere, hydrosphere, biosphere) as a consequence of armed conflict; b) *environmental degradation* (due to poverty, injustice, population growth) as a *cause* of conflict; and c) *self-reinforcing environmental degradation* (refugees, food riots, urban violence) as a *contribution* to armed conflict. Both environmental impacts of military activities and of wars, and the environment as a cause or contributing factor to hazards, migration, crises and in the extreme case also to conflicts have posed ‘threats’, ‘challenges’, ‘vulnerabilities’ and ‘risks’ that have been conceptualized since the late 1980’s in the context of US ‘na-

23 See the complete list of UNISDR key terminology on *Disaster Risk Reduction* at: < <http://www.unisdr.org/eng/terminology/terminology-2009-eng.html> > that reflects the ISO guide on risk management.

Table 2.1: Selected UNISDR key terminology on *Disaster Risk Reduction*. **Source:** UNISDR; at: <<http://www.unisdr.org/eng/terminology/terminology-2009-eng.html>>.

Term	Definition	Comment
Acceptable risk	The level of potential losses that a society or community considers acceptable given existing social, economic, political, cultural, technical and environmental conditions.	In engineering terms, acceptable risk is also used to assess and define the structural and non-structural measures that are needed in order to reduce possible harm to people, property, services and systems to a chosen tolerated level, according to codes or 'accepted practice' which are based on known probabilities of hazards and other factors.
Corrective disaster risk management	Management activities that address and seek to correct or reduce disaster risks which are already present.	This concept aims to distinguish between the risks that are already present, and which need to be managed and reduced now, and the prospective risks that may develop in future if risk reduction policies are not put in place. See also Prospective risk management.
Disaster risk	The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period.	The definition of disaster risk reflects the concept of disasters as the outcome of continuously present conditions of risk. Disaster risk comprises different types of potential losses which are often difficult to quantify. Nevertheless, with knowledge of the prevailing hazards and the patterns of population and socio-economic development, disaster risks can be assessed and mapped, in broad terms at least.
Disaster risk management	The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.	This term is an extension of the more general term 'risk management' to address the specific issue of disaster risks. Disaster risk management aims to avoid, lessen or transfer the adverse effects of hazards through activities and measures for prevention, mitigation and preparedness.
Disaster risk reduction	The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.	A comprehensive approach to reduce disaster risks is set out in the United Nations-endorsed Hyogo Framework for Action, adopted in 2005, whose expected outcome is "The substantial reduction of disaster losses, in lives and the social, economic and environmental assets of communities and countries." The International Strategy for Disaster Reduction (ISDR) system provides a vehicle for cooperation among Governments, organizations and civil society actors to assist in the implementation of the Framework. Note that while the term 'disaster reduction' is sometimes used, the term 'disaster risk reduction' provides a better recognition of the ongoing nature of disaster risks and the ongoing potential to reduce these risks.
Disaster risk reduction plan	A document prepared by an authority, sector, organization or enterprise that sets out goals and specific objectives for reducing disaster risks together with related actions to accomplish these objectives.	Disaster risk reduction plans should be guided by the Hyogo Framework and considered and coordinated within relevant development plans, resource allocations and programme activities. National level plans need to be specific to each level of administrative responsibility and adapted to the different social and geographical circumstances that are present. The time frame and responsibilities for implementation and the sources of funding should be specified in the plan. Linkages to climate change adaptation plans should be made where possible.
Extensive risk	The widespread risk associated with the exposure of dispersed populations to repeated or persistent hazard conditions of low or moderate intensity, often of a highly localized nature, which can lead to debilitating cumulative disaster impacts.	Extensive risk is mainly a characteristic of rural areas and urban margins where communities are exposed to, and vulnerable to, recurring localized floods, landslides storms or drought. Extensive risk is often associated with poverty, urbanization and environmental degradation. See also 'Intensive risk'.

Term	Definition	Comment
Intensive risk	The risk associated with the exposure of large concentrations of people and economic activities to intense hazard events, which can lead to potentially catastrophic disaster impacts involving high mortality and asset loss.	Intensive risk is mainly a characteristic of large cities or densely populated areas that are not only exposed to intense hazards such as strong earthquakes, active volcanoes, heavy floods, tsunamis, or major storms but also have high levels of vulnerability to these hazards. See also 'Extensive risk'.
National platform for disaster risk reduction	A generic term for national mechanisms for coordination and policy guidance on disaster risk reduction that are multi-sectoral and inter-disciplinary in nature, with public, private and civil society participation involving all concerned entities within a country.	This definition is derived from footnote 10 of the Hyogo Framework. Disaster risk reduction requires the knowledge, capacities and inputs of a wide range of sectors and organizations, including United Nations agencies present at the national level, as appropriate. Most sectors are affected directly or indirectly by disasters and many have specific responsibilities that impinge upon disaster risks. National platforms provide a means to enhance national action to reduce disaster risks, and they represent the national mechanism for the ISDR.
Prospective disaster risk management	Management activities that address and seek to avoid the development of new or increased disaster risks.	This concept focuses on addressing risks that may develop in future if risk reduction policies are not put in place, rather than on the risks that are already present and which can be managed and reduced now. See also Corrective disaster risk management
Residual risk	The risk that remains in unmanaged form, even when effective disaster risk reduction measures are in place, and for which emergency response and recovery capacities must be maintained.	The presence of residual risk implies a continuing need to develop and support effective capacities for emergency services, preparedness, response and recovery together with socio-economic policies such as safety nets and risk transfer mechanisms.
Risk	The combination of the probability of an event and its negative consequences.	This definition closely follows the definition of the ISO/IEC Guide 73. The word 'risk' has two distinctive connotations: in popular usage the emphasis is usually placed on the concept of chance or possibility, such as in 'the risk of an accident'; whereas in technical settings the emphasis is usually placed on the consequences, in terms of 'potential losses' for some particular cause, place and period. It can be noted that people do not necessarily share the same perceptions of the significance and underlying causes of different risks.
Risk assessment	A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.	Risk assessments (and associated risk mapping) include: a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. This series of activities is sometimes known as a risk analysis process.
Risk management	The systematic approach and practice of managing uncertainty to minimize potential harm and loss.	Risk management comprises risk assessment and analysis, and the implementation of strategies and specific actions to control, reduce and transfer risks. It is widely practised by organizations to minimize risk in investment decisions and to address operational risks such as those of business disruption, production failure, environmental damage, social impacts and damage from fire and natural hazards. Risk management is a core issue for sectors such as water supply, energy and agriculture whose production is directly affected by extremes of weather and climate.

Term	Definition	Comment
Risk transfer	The process of formally or informally shifting the financial consequences of particular risks from one party to another whereby a household, community, enterprise or state authority will obtain resources from the other party after a disaster occurs, in exchange for ongoing or compensatory social or financial benefits provided to that other party.	Insurance is a well-known form of risk transfer, where coverage of a risk is obtained from an insurer in exchange for ongoing premiums paid to the insurer. Risk transfer can occur informally within family and community networks where there are reciprocal expectations of mutual aid by means of gifts or credit, as well as formally where governments, insurers, multilateral banks and other large risk-bearing entities establish mechanisms to help cope with losses in major events. Such mechanisms include insurance and re-insurance contracts, catastrophe bonds, contingent credit facilities and reserve funds, where the costs are covered by premiums, investor contributions, interest rates and past savings, respectively.

tional security’ and since the 1990’s increasingly also as dangers to ‘human security’.

Within the framework of national security Mathews (1989) and Myers (1989, 1989a) argued: “First there was a need to redefine security and to include a new range of threats. ... Second, there was an acceptance that the object of security was no longer simply the state, but ranges to levels above and below the level of the state” (Lonergan 2002: 270-271). Mathews (1989: 162) proposed a “broadening definition of national security to include resource, environmental and demographic issues”. She warned that global changes “in the chemical composition of the atmosphere, in the genetic diversity of species inhabiting the planet, and in the cycling of vital chemicals through the oceans, atmosphere, biosphere and geosphere” could lead to irreversible damage. Myers (1989: 23-41) pointed to several environmental factors (soil erosion, ozone layer, climate change) as legitimate causes for international concern that may have repercussions for US security policy. Myers (1993, 1994, 1996: 12) also claimed that the “principal threat to security and peace stems from environmental breakdown” and that environmental problems can “figure as causes of conflict”, such as water in the Middle East, desertification in the Sahel, water diversion or flooding in Bangladesh. Myers (1993: 20-21) equated security with “human well-being; not only from harm and injury but access to water, food, shelter, health, employment, and other basic requisites”. He warned if the environmental foundations are depleted:

the nation’s economy will eventually decline, its social fabric will deteriorate, and its political structure will become destabilized. The outcome is all too likely to be conflict, whether in the form of disorder and insurrection within a nation or tensions and hostilities with other nations. ... National security is no longer about fighting forces and weaponry alone. It relates to watersheds, croplands, forests, genetic resources, climate, and other factors rarely considered by military experts and

political leaders, but that taken together deserve to be viewed as equally crucial to a nation’s security as military prowess.

Myers (1996: 22) analysed as environmental factors contributing to conflict: population growth, ozone layer depletion and global warming, mass extinction of species and as a direct consequence: environmental refugees. These ‘Neo-Malthusian’ (Malthus 1789 [1993]) and ‘realist’ concerns that focused on the ‘state’ as the major referent object had a conceptual impact on the US defence and security policy during the Clinton administration but they were discontinued by his successor (Matthew/McDonald 2009).

2.6.2 ‘Environmental Security Agenda’ as an Object of Securitization

Simultaneously the Copenhagen school has widened the scope of security from a ‘constructivist perspective’. According to Buzan, Kelstrup, Lemaitre, Tomer and Wæver (1990) “*Environmental security* concerns the maintenance of the local and the planetary biosphere as the essential support system on which all human enterprises depend.” Later, Buzan, Wæver and de Wilde (1998: 71-93) noted a scientific and a political agenda on how to analyse and deal with these concerns.

The scientific agenda underpins securitizing moves, whereas the political agenda is about three areas: (1) state and public awareness of issues on the scientific agenda ...; (2) the acceptance of political responsibility for dealing with these issues; and (3) the political management questions that arise: problems of international cooperation and institutionalization - in particular regime formation, the effectiveness of unilateral national initiatives, distribution of costs and benefits, free-rider dilemmas, problems of enforcement, and so forth (Buzan/Wæver/de Wilde 1998: 72).

On the scientific environmental agenda the following issues are often included (Buzan/Wæver/de Wilde

1998: 74–75): a) *Disruption of ecosystems* (climate change; biodiversity loss, deforestation, desertification, soil erosion; ozone layer depletion; pollution); b) *energy problems* (natural resource depletion, pollution, disaster depletion, nuclear energy, oil transportation, chemical industries, scarcities, uneven distribution); c) *population problems* (population growth, consumption beyond carrying capacity, epidemics, poor health conditions, declining literacy rates, uncontrollable migrations, unmanageable urbanization); d) *food problems* (poverty, famines, overconsumption, diseases related to extremes; loss of fertile soils and water resources; epidemics and poor health conditions; scarcities, uneven distribution); e) *economic problems* (protection of unsustainable production, societal instability leading to cyclical and hegemonic breakdowns, structural asymmetries and inequality); and f) *civil strife* (war-related environmental damage and violence related to environmental degradation). Securitization efforts were made at all levels but the most effective were on the local level. For Buzan (2004), the ‘state’ and the ‘society’ remained major referents of securitization, and he was sceptical to the human security concept. More recently, Buzan and Hansen (2009) reviewed the gradual development of environmental security in a broader and systematic context of the evolution of international security studies.

2.6.3 ‘Environmental Security Issues’ as New Causes of Conflicts

So far four phases of research on environmental security issues have been distinguished. Dalby, Brauch and Oswald Spring (2009) have recently reviewed the first three phases of environmental security research and Oswald Spring, Brauch and Dalby (2009; Brauch 2003, 2003a) have suggested to include in the research agenda for the fourth research phase, a human security perspective and to address gender issues and natural hazards. In this volume, Brauch, Dalby and Oswald Spring (chap. 94) suggest a new multidisciplinary approach of a ‘political geoecology’ and to introduce the ‘political’ dimension into Earth Systems Science as well as knowledge from the natural sciences into the discourses on environmental and human security.

In the centre of the second empirical phase of the debate on environmental security have been many case studies conducted by two research teams in Toronto (Homer Dixon 1991, 1994, 1999, 2000), and in Zurich and Berne (Bächler/Spillmann 1996, 1996a,

1996b; Bächler 1999; Bächler/Spillmann/Suliman 2002). They focused on the linkages between environmental stress and extreme outcomes: societal crises, domestic or international conflicts and cooperation.

While these case studies focused primarily on environmental scarcity (*‘grievance’*) other more recent studies have argued that resource abundance (diamonds, coltan et cetera) or ‘greed’ has been a major cause for the new wars by local war lords (Gleditsch 2001, 2003; Conca/Dabelko 2002; Collier 2000, Bannon/Collier 2003; Collier/Elliott/Hegre/Hoeffler/Reynal Querol/Sambanis 2003). A recent study by Kipping (2009) has shown that water scarcity in the Senegal River basin has been the reason for cooperation between Senegal and Mauritania. But after the building of dams and introduction of irrigated agriculture water abundance had become a cause of violent conflict.

John Gerard Ruggie (1998: 155–171) argued on the eco-demographic contexts of emerging new conflicts in developing countries that a part of the populations may experience “institutional barriers long before they encounter absolute physical scarcity” which may result in a spillover of population pressures into international conflict behaviour. On rapid urbanization, Ruggie (1998: 163) emphasized that social turmoil may result from the “insufficient capacity on the part of the cities to service such large increments of population in so short a time. A social turmoil in turn may provide targets of opportunity, either for domestic forces to internationalize the problem or for foreign forces to meddle in domestic affairs”. Ruggie concluded that in contrast to the past, the “interplay between socio-economic forces and biophysical factors have reached a planetary scale”.

Paul Kennedy (2000: 239–245) stated that environmental pressures “could produce threats to human well-being and social stability” and that, if the projected effects of climate change are accurate, “then mankind will face atmospheric turbulences and environmental hazards in the future that will cause distress: melting of the polar ice caps, rise in sea levels, more extreme weather conditions, greater storm damage, crop displacement, and habitat changes”, challenges that could be addressed with regular means, at least in the US. But on the regional and local level these environmental damages could result in unrest and migration often combined with violence. He argued that the new global challenges, including global warming and migration pressure, which are further intensified by demographic and environmental stress, bring some societies to worrying thresholds and thus

could become threats to national and international stability.

Since 2007, climate change has been added to the political and scientific agenda as an object of securitization and as a potential cause of international, national and human security as well as a trigger or force multiplier resulting in different forms of primarily small-scale conflict.²⁴ At least five different approaches may be distinguished of policy analysis, causal analysis, scenario analysis, discourse analysis (of securitization moves by policy-makers and international organizations) and quantitative correlation analyses.

2.6.4 Environmental Security 'Threats', 'Challenges', 'Vulnerabilities', and 'Risks'

Security with its dual focus is achieved if there is an absence of objective threats and subjective fears to basic values. The ecosystem was introduced as the reference object of '*environmental security*'. Its values at risk are sustainability and the sources of dangers are humankind and global environmental change. The environment is considered both as a cause and an object of specific threats, challenges, vulnerabilities, and risks posed by GEC, by environmental pollution and by natural hazards to the 'objective' and 'subjective' security of human beings and humankind (*human security*), of societal groups (*societal security*), of nation states (*national security*), and of association of states (*European security*) from the impacts in the most affected states outside of the EU, for macro regions (*regional security*), and in a few extreme cases, such as 'abrupt climate change' (NRC 2002) also for the Earth (*global security*). While most securitization efforts have focused on the 'state' or on the 'society' as major referent objects, Westing (1989, 1989a: 129–134) introduced the environment into a 'comprehensive human security' concept that requires both a *protection* (quality of the environment) and a *utilization* requirement (human welfare). In this concept renewa-

ble natural resources must be used in a sustainable way.

Table 2.2 provides a heuristic compilation of possible linkages between environmental causes, stressors, impacts or outcomes that may pose security threats, challenges, vulnerabilities, and risks for human beings or humankind within their respective natural environment. Natural and human-induced hazards are rapid onset events also influenced by long-term, creeping or structural factors or processes.

Hazards and hazard-induced distress or forced migration may trigger socio-political consequences beyond the traditional scope of the hazard community, such as societal crises among residents and migrants competing for scarce soil and water for food security and survival.²⁵ These socio-political consequences have become an object of securitization in the context of a human security approach with the affected human beings as referent objects.

2.6.5 Environmental Factors as Security Threats, Challenges, Vulnerabilities, and Risks

Contrary to the 'state-centred national security' concepts of the realist school, global environmental change, as well as hydro-meteorological hazards, affect primarily the individual or humankind whose perception of 'insecurity' therefore change. Environmental factors, both *rapid-onset* hydro-meteorological hazards and *creeping* challenges posed by global environmental change have increased 'human insecurity' by confronting the highly vulnerable and poor people with a 'survival dilemma' (Brauch 2008b): either to stay at home in their village continuing their traditional livelihood, or to move first to the next major urban centre. The young and those who can afford it have of course a third possibility: to move to a country or a region that offers them better economic conditions and future prospects for survival of their family.

Hazard-induced or environmentally triggered distress migration has become a major 'human' and 'societal' security challenge for the 21st century. In Europe, in the US, but also in India, the counter strategies have been similar in tightening border controls. However, these measures could neither stop nor prevent immigration, they rather increased the number of illegal immigrants from Mexico to the US (Oswald

24 There is rapidly growing political, consultancy and scientific literature on the 'climate change-security-conflict' nexus: BMU 2002; WBGU 2007, 2008; EU 2008; UNSG 2009; Maas/Tänzler 2009; Bushby 2009; Breitmeyer 2009; Gleditsch/Nordas 2009; Brauch 2009a; chap. 1 by Brauch/Oswald Spring and 95 by Oswald Spring/Brauch; chap. 41 by Bauer; chap. 42 by Schefran.

25 See e.g.: Biermann and Boas (2007); Brown (2008); Warner, Afifi, Dun, Stal and Schmidl (2008); Black (2006).

Table 2.2: Compilation of environmental threats, challenges, vulnerabilities, and risks. **Source:** Compiled by the author.

Environmental causes, stressors, effects and natural hazards that pose	Natural and economic factors		Societal impact factors (exposure)	
	Substantial threats for	Challenges affecting	Vulnerabilities for	Risks for
	Security objects (for what or whom?)			
Climate change • temperature increase (creeping, long-term)	• Human health • agriculture (yield decline) • biodiversity • desertification	• tourism • food security • fisheries • government action • economic action	• infectious disease • damage to crops • natural systems • water scarcity • forest fire	• human populations • the poor, old people and children due to heatwaves
Climate change • sea level rise (creeping, long-term)	• Small island states • marine ecosystem, • indigenous communities, • industry, energy	• deltas • coastal zones • marine, freshwater ecosystems	• coastal cities, habitats, infrastructure, jobs • cities, homes, jobs	• livelihood • poor people, • insurance, • financial services
Climate change • -Extreme weather events: • storms (hurricanes, cyclones, winter storms)	• Habitat, technical infrastructure, transportation, etc	• forests (health of trees) • food security	• coastal ecosystems • forests, settlements • electricity transmission	• human life & property • insurance, • financial services
Climate change • Extreme weather events: floods	• Habitat, technical infrastructure and people	• vulnerable, flood-prone areas	• persons living in flood-prone areas	• human life & property
Climate change • Extreme weather events: drought	• Availability of water and food, survival of people	• decreased crop yield and water quality & quantity	• arid and semi-arid zones, agriculture • forests (tree health)	• human life & animals, property
Tipping points in the climate system (crossing thresholds due to linear climate change impacts) ^{a)}	• unforeseeable consequences • for water, soil, food and livelihood security	• agriculture, • tourism • urban habitats	• damage to crops • natural systems • water scarcity • forest fire	• human populations • the poor, old people and children due to heatwaves
Abrupt climate change (shutoff of the Gulf Stream in the North Atlantic) • e.g. cooling in Central and Northern Europe, in North America (USA)	• Countries and people in Northern Europe, benefiting from Gulf Stream	• livelihood • survival	• agriculture • habitat • people	• human life & animals, property • forced migration of people
Geophysical hazards • earthquakes, • volcanic eruptions • tsunamis	Hazard prone areas • regional and local affected areas • coastal areas (in Indian Ocean)	• habitat, • technical & economic infrastructure • people	• poor living in hazard prone areas and in vulnerable housing	• poor people with little resilience & disaster preparedness, no insurance
Soil erosion, desertification, drought	• water scarcity • agriculture • habitats	• food security • human livelihood (forced migration)	• livelihoods • rural areas • specific crops	• people & livestock in rural areas • people in slums

Table 2.2: Compilation of environmental threats, challenges, vulnerabilities, and risks. **Source:** Compiled by the author.

Deforestation	• Landscape, cities, habitat	• water availability	• landslides	• informal housing (slums)
Water scarcity and degradation	• Agriculture, food security, people	• econ. behaviour • human health	• poor in slums	• old people, children, poor
Forced Migration	• Resident population, clash on water and food	• overgrazing on marginal soils, • environment	• fragile ecosystems • people on the move	• migrants and their animals

a) Lenton, Held, Kriegler, Hall, Lucht, Ramsdorf, and Schellnhuber (2008: 1186) argued that the term ‘tipping point’ has been used in discussions of global change “to describe a variety of phenomena, including the appearance of a positive feedback, reversible phase transitions, phase transitions with hysteresis effects, and bifurcations where the transition is smooth but the future path of the system depends on the noise at a critical point”. They offered “a formal definition, introducing the term ‘tipping element’ to describe subsystems of the Earth system that are at least subcontinental in scale and can be switched – under certain circumstances – into a qualitatively different state by small perturbations. The tipping point is the corresponding critical point – in forcing and a feature of the system – at which the future state of the system is qualitatively altered”. They pointed to the melting of the Arctic sea-ice, rapid changes in the Greenland and in the West Antarctic ice sheet, a shutoff of the Gulf Stream (Atlantic Thermohaline Circulation), changes in the El Niño-Southern Oscillation (ENSO), in the Indian summer monsoon, in the Sahara/Sahel and West African monsoon, a drying of the Amazon basin and changes in boreal forests. The potential political and security consequences of these non-linear or chaotic perturbations in the climate system once unknown thresholds have been crossed have not yet been analysed and may only be discussed in the context of worst-case impact scenarios.

Spring/Brauch 2005; Verduzco/de Lozano 2010; chap. 26 by Brauch and chap. 47 by Brauch/Oswald Spring).

2.6.6 Proactive Security Response Strategies

Addressing the environmental dangers to security (table 2.2) requires a complex combination of strategic instruments and policies to reduce the vulnerability to natural hazards and the related risks for human beings and affected societal groups. Thus a dual strategy is needed for dealing with: *short-term situational* impacts of extreme weather events and natural hazards; and *longer-term structural impacts* of global environmental change. While the global environmental change, the climate change and the hazard research communities have used different concepts of environmental, social and economic vulnerabilities and risks, a conceptual and a policy-oriented mainstreaming is needed to address both impacts. Three groups of vulnerability and risk indicators are needed: for both climate change and hydro-meteorological hazards; for specific hazards (storms, floods, drought), and for temperature increase and sea-level rise.

Thus, effective climate policies with legally binding obligations may be the most cost-effective solutions to counter the projected increase in extreme weather events. To respond to these complex and manifold environmental security threats, challenges,

vulnerabilities, and risks as well as to those posed by manifold hazards, it is primarily *proactive* non-military policies and measures (table 2.3) which are needed. More conceptual work on the linkages between ‘environmental’ and ‘human’ security is necessary, but also between economic production and ecosystems (N. Georgescu-Roegen 1971). Mainstreaming efforts are required on the scientific and political tracks with regard to the environmental dimension of human security (conceptualization in the scientific community); and a ‘paradigm shift’ in the UN system from ‘national’ towards ‘human security’ perspectives.

With regard to the work of international organizations, a dual mainstreaming may be needed:

- to incorporate a ‘human security perspective’ into environmental security initiatives, such as ENVSEC of OSCE, UNEP, UNDP²⁶ and NATO (Cheterian 2009) into the green diplomacy of the European Union launched at the European Council in Thessaloniki in June 2003; and
- to include an ‘environmental security dimension’ into the work of the *Human Security Network*

26 See the joint initiative of OSCE, UNEP and UNDP on: *An Environment Agenda for Security and Cooperation in South Eastern Europe and Central Asia*; at: <<http://www.iisd.org/natres/security/envsec/>>; <www.osce.org/documents/sg/2003/01/324_en.pdf>; and at: <<http://www.oecd.org/dataoecd/53/3/33687392.pdf>>.

Table 2.3: Human security policies and measures for coping with environmental threats, challenges, vulnerabilities, and risks for ecosystems and sustainability. **Source:** Compiled by the author.

Strategies and means for coping with	Threats of	Challenges for	Vulnerabilities of	Risks of
Environmental Security for				
<i>Sustainable development</i> policy goals	• Air (climate), soil, water	• agriculture and food security	• vulnerable people (old, children, women, indigenous groups)	
<i>Environment policy</i> (implementation of environmental treaties, regimes)	• Climate change, soil erosion, water scarcity and degradation	• economy • agriculture • tourism • health	• rural livelihood • urban habitat • transport & economic infrastructure	• reducing exposure of people with low resilience
<i>Early recognition</i> (research, education, training, agenda-setting)	• Extreme weather events (storm, flood, drought)	• agriculture (shift in crops)	• city planning • building standards	• enhancing knowledge of these people
Early warning of hazards and disasters	• Hydro-meteorological (storms, floods, drought) and geophysical (earthquake, volcano, tsunami) hazards	• agriculture (specific crops) • public health	• vulnerability mapping of hazard prone areas and housing	• enhancing training of these people
Effective disaster preparedness and rapid disaster response		• (inter)national organizations and resources	• vulnerability mapping of hazard prone areas and housing	• enhancing protection of these people
Humanitarian aid	• Hazards and conflicts	• access to affected areas	• spread of infectious disease	• reducing low recognition
Refugee assistance	• Distress migration	• environment • food supply	• refugees (in times of conflict)	• old, weak and poor

(HSN) focusing primarily on ‘freedom from fear’, elaborating it further also in the context of the report of the *Commission on Human Security* (CHS 2003) focusing on ‘freedom from want’ by adding a new pillar of ‘freedom from hazard impact’ (Brauch 2009b; Fuentes Julio/Brauch 2009);

- to launch a Mediterranean Environmental and Human Security Initiative (MEH-SEC) within the Union for the Mediterranean (Brauch 2010).

Including vulnerability concerns into the human security concept and in their environmental management plans requires the active involvement of other UN agencies and programmes.

2.7 Human Security Threats, Challenges, Vulnerabilities, and Risks

Parallel to the academic debate on environmental security that influenced the policy agenda of several international organizations, the human security concept used by UNDP (1994) triggered a global and ongoing political and scientific debate. UN Secretary-

General Kofi Annan (2001) has referred to the need for a human-centred approach to security that must encompass “economic development, social justice, environmental protection, democratization, disarmament, and respect for human rights and the rule of law”.

UNESCO (1997, 1998, 1998a, 2001, 2001a, 2003) has been instrumental for initiating and supporting the scientific debate on ‘human security’ especially in developing countries, by organizing regional conferences in all parts of the world (UNESCO 2008; Goucha/Crowley 2008). These regional conceptual efforts have linked the debate with pertinent security concerns. An intensive debate is continuing in OECD countries and there is a growing debate in developing countries focusing on specific ‘human security’ (HS) threats, challenges vulnerabilities, and risks (Brauch 2009b).

2.7.1 Towards a Human-centred Environmental Security Concept

What poses a threat, challenge, vulnerability or risk to human security, both to the individual human being

or to humankind, depends on whether a 'wide' or a 'narrow' HS concept is chosen focusing on 'freedom from want' (Japanese concept, CHS 2003), 'freedom from fear' (Norwegian and Canadian concept), 'freedom to live in dignity' (Annan 2005) or 'freedom from hazard impact' (Bogardi/Brauch 2005). GECHS (1999) argued that the following types of environmental change affect *human security*: a) natural disasters, b) cumulative changes or slow-onset changes, c) accidental disruptions or industrial accidents, d) development projects, and e) conflict and warfare.

Barnett (2001: 127) considered a "human-centred environmental security concept" as justified on moral and pragmatic grounds "because addressing the welfare of the most disadvantaged means addressing many of the future sources of environmental degradation" by protecting the rights of the most vulnerable members of society and by enhancing "welfare, peace and justice" on which legitimate institutions should be built which are required "for human and environmental security" (Conca 1994, 1994a). Najam (2003: 1-24) proposed an environment and security discussion around two sources of insecurity (violent conflict and social eruption), and to focus the analysis on state centred and society centred activities. This leads him to four outcomes: 1) *interstate war* (state centred violent conflict); 2) *civil strife* (society centred violent conflict); 3) *institutional failure* (state centred social disruption); and 4) *human insecurity* (as a society centred social disruption).

Barnett, Matthew and O'Brien (2008) and Matthew, Barnett, Mc Donald and O'Brien (2010, 2010a) offered a glimpse on the work the *Global Environmental Change and Human Security* (GECHS) project within the *International Human Dimensions Programme* (IHDP) that has been pursued from 1996 to June 2009 when the project ended with a synthesis conference. Barnett, Matthew and O'Brien (2010: 4) argued that "global environmental change poses new and in some cases unprecedented threats to human security ... that transcend the North-South binary and the 'rich-poor' dichotomy" and they discussed "how a human security orientation to environmental change can contribute to initiatives such as the Millennium Development Goals (MDGs)". In contrast to national or state security, human security "securitizes ... what individuals themselves see as their paramount concerns, and so pluralizes the meaning of security and opens up space for alternative security practices. It adds to the concept of human development ... by focusing on immediate concerns such as basic needs and peace, and by directing attention toward the most

vulnerable (Gasper/Truong 2005)" (Barnett/Matthew/O'Brien 2010: 9). They concluded that "global environmental change is adding impetus to the realization that traditional understandings of security are limited and are an inadequate basis for making policy" and that GEC "is raising new and unavoidable question to equity and sustainability, which already underlie every aspect of human security". Finally they called "for greater integration of the security, development, and sustainable development research and policy communities, which have for too long been too distinct".

2.7.2 Human Security Threats, Challenges, Vulnerability, and Risks

From a human security perspective many threats, challenges, vulnerabilities, and risks exist for the major referent: the individual human being or humankind in contrast to the state in prevailing national security concepts. From a human security perspective all five security dimensions and also sectoral security concepts may be analysed. Human security is infringed by underdevelopment ('want'), conflicts and human rights violations ('fear'), by hazards and disasters ('hazard impact') and by the violation of human rights ('to live in dignity'). These four pillars of human insecurity pose threats, challenges, vulnerabilities, and risks to different aspects of human security and call for three different but interrelated strategies for coping and overcoming human insecurity for which different national and international organizations and means are needed.

All four pillars of human insecurity (want, fear, hazard impact, indignity) also impact on health insecurity. Chen and Narasimhan (2003: 3-12) in their human security agenda for global health argued that three factors: 1) conflicts and humanitarian emergencies; 2) infectious crisis (HIV/AIDS); and 3) impoverishment impact on illness, injury, disability, death posing critical pervasive threats to the vital core of human security: human survival and flourishing; livelihood; and dignity. For Leaning, Arie, Holleufer and Bruderlein (2003: 13-30) measuring human security focuses on the fulfilment of basic needs, and home, community and future.

Table 2.4: Compilation of human security threats, challenges, vulnerabilities, and risks. **Source:** Compiled by the author.

Dangers for Human Security Posed by	Human Security			
	Threats to	Challenges for	Vulnerabilities to	Risks for
Underdevelopment ('freedom of want')	<ul style="list-style-type: none"> • Human well-being, • human health • life expectancy 	<ul style="list-style-type: none"> • social safety nets • human development • food security 	<ul style="list-style-type: none"> • economic crisis and shocks • communicable diseases 	those most vulnerable (socially, economically) and exposed to underdevelopment, violence and hazards: <ul style="list-style-type: none"> • peasants, • poor • women, • children, • old people • indigenous people • minorities.
Conflicts and human rights violations ('freedom from fear')	<ul style="list-style-type: none"> • Human life and personal safety (from wars) • identity, values 	<ul style="list-style-type: none"> • feeling secure in a community • human rights • democracy 	<ul style="list-style-type: none"> • warlords, criminals • corrupt regime, ruler • human rights abuses, violations 	
Hazards and disasters ('freedom from hazard impact')	<ul style="list-style-type: none"> • Livelihood • survival • settlements, urban slums 	<ul style="list-style-type: none"> • sustainable development • food security 	<ul style="list-style-type: none"> • exposed population • livelihoods, habitat • disease (cholera, dengue, malaria, etc.) 	
Violation of basic laws, lack of good governance ('freedom to live in dignity')	<ul style="list-style-type: none"> • human dignity, • human rights, • basic human needs 	<ul style="list-style-type: none"> • rule of law, • democratic system of rule • peaceful conflict resolution 	<ul style="list-style-type: none"> • corruption and organized crime 	<ul style="list-style-type: none"> • rights of the citizens • human well-being

2.8 Conclusions for Research and Policy Suggestions

This survey reviewed the many political and scientific concepts dealing with four basic dangers undermining security, namely 'threats', 'challenges', 'vulnerabilities', and 'risks'. These concepts have been used in several scientific disciplines (political science, economics, psychology, sociology, international law) and research communities focusing on global environmental change, sustainable development, climate change as well as on hazards and disasters both in policy discourses and declarations.

This survey of scientific concepts has been a part of a scientific effort to reconceptualize security, its five dimensions, its levels of analyses since the global turn of 1989 and 1990 (global security order), since the terrorist attack on the United States of 11 September 2001 resulting in 'personal violence' and wars (Afghanistan, Iraq) and since the global financial crisis of 2008 resulting in 'structural violence' where millions of people lost their homes (e.g. in the United States), their income (rise in global unemployment, loss of pensions), their right to food (price hikes in basic food staples with resulting food riots during

2008 and major increase in hunger in the poor countries and among the poorest people in many countries since 2008 and 2009).

Due to globalization, trade flows, foreign investments and the exchange of information based on new forms of communication have not only increased, but non-state actors and processes beyond the control of the nation states and international organizations have also posed multiple new security threats, challenges, vulnerabilities, and risks that have resulted in new forms of 'invisible' antipersonnel and structural terrorism. While the instigators of the antipersonnel terrorism have become the object of a 'war on terror', those who caused and are responsible for the new 'structural terrorism' that deprived millions of people of their livelihood, income, economic well-being, and that threatened the common European currency have so far remained a part of the system that determined the rules that made this form of structural terrorism possible, and it is unclear whether the rules will or can be changed to permit that they can be brought to justice for violating national laws.

Since 1990 in many countries a widening of security has occurred away from the narrow military, political and economic security of the Cold War towards a

wider scope that has also included societal and environmental dimensions, but also a temporary return to a narrow Hobbesian (1651, [1965], 1658) primarily military security concept. In the 21st century, with regard to the thinking on security and sovereignty, three different contexts have coexisted:

- the *pre-modern* world where state sovereignty and the ability to rule the whole state territory has ceased to exist in so-called ‘failing’, or ‘failed states’, many of them having fallen victim to internal conflicts or civil wars where warlords control part of the country and major resources;
- the *modern* world where the defence of the Westphalian state and of its population and territory against undue outside intervention and intrusion is a major goal of ‘national security’ policies;
- the *postmodern* world where a progressive internal de-borderization (e.g. within the EU) combined with a tightening of external borders has occurred and both integration and globalization processes have reduced the classical *domaine réservé* of the nation state.

In addition, since the early 1990’s, influenced by the concerns for ‘human development’ (UNDP 1994), a shift in the referent object of the security concept has taken place from an exclusive focus on the ‘nation state’ to ‘human beings and humankind’ or from the prevailing ‘national security’ to ‘human security’. Since the late 1990’s two parallel debates have taken place on ‘environmental security’ and on ‘human security’ both in the social sciences and within international organizations that have also been stimulated by several international commissions and high-level expert panels.

Within the UN system, UNU-EHS has started to advance the development of the ‘environmental dimension of human security’ (Bogardi/Brauch 2005; Brauch 2003, 2005, 2005a, 2008a) trying to bring both scientific and political communities together, and to develop the conceptual ideas of those further (Barnett 2001) who have called for a ‘human centred environmental security’ concept. Conceptualizing the ‘environmental dimension of human security’ implies that the victims (human beings and humankind), their social, economic, environmental and political vulnerabilities and risks become the central object of analysis and not only the state, its institutions and governance structures, strategies, policies, and measures.

Since the early 1990’s, the scientific and conceptual debate on security concepts has proliferated from the OECD countries to other regions and to develop-

ing countries that have been major victims of the interaction between humankind and global environmental change, and where the need to overcome ‘want’ (development) and ‘fear’ (cooperation, disarmament, human rights) as well as to reduce the ‘impact of hazards’ is most severe and where the right to live in dignity and under good governance must still be realized. This survey of the conceptual thinking on *security threats, challenges, vulnerabilities, and risks* has stressed a dual need for:

- *more precise definitions* to reach a consensus on these concepts especially with regard to practical political measures to achieve the agreed goals; and
- *a systematization of the threats, challenges, vulnerabilities, and risks* for military, diplomatic, economic, societal, environmental as well as human, food, health, energy, livelihood, and gender security (Brauch/Oswald Spring/Grin/Mesjasz/Kameri-Mbote/Chadha Behera/ Chourou/Krummenacher 2009).

However, the latter is influenced by the political mindset of policy-makers and by the scientific worldview (chap. 95 by Oswald Spring/Brauch), disciplinary and theoretical approaches and models, as well as by the economic status and by the geographic location of the country concerned but also by the systems of rule and the level of participation of civil society in local, provincial and national decision-making.

For the hazard community, the concepts of vulnerability and risk have been crucial in a wider context that moves from the purely physical aspects of natural hazards to an assessment and ranking of vulnerability through indicators where the *environmental* (air, soil, water, ecosystems, natural resources), the *economic* (development, resources), the *social* (coping capacities), but also the *political* (governance, participation) contexts are fully taken into account.

A major conceptual and policy task could be to develop the new pillar of human security as ‘freedom from hazard impact’, and to contribute to the implementation of this goal through capacity-building for early warning, developing vulnerability indicators (Birkmann 2006), and vulnerability mapping (Bankoff/Frerks/Hilhorst 2004). While human-induced and natural hazards cannot be prevented, the impact of tragic events, like the Tsunami of 26 December 2004 in the Indian Ocean, Hurricane Katrina in 2005, or the earthquakes in Haiti and Chile in January and February 2010, can be reduced primarily by measures of early warning and better disaster preparedness that address the ‘social vulnerability’ of those

most exposed to both hydro-meteorological and geophysical hazards. The fourth pillar of human security aiming at 'freedom from hazard impact' would imply that people are empowered to mobilize and use their resources to address sustainable development goals rather than remain in the vicious cycle of a 'survival dilemma' (Brauch 2008b).

Human security as 'freedom from hazard impact' is achieved when people who are vulnerable to these manifold environmental hazards and disasters (floods, landslides, and drought) often intensified by other associated societal threats (poverty), challenges (food insecurity), vulnerabilities and risks (improper housing in highly vulnerable flood-prone and coastal areas) are better warned of impending hazards, prepared, and protected against these impacts and are empowered to prepare themselves effectively to avoid and to cope with the 'survival dilemma' that often occurs during conflicts, natural hazards, and in complex emergencies where both coincide.