Workshop on "Fostering innovative dialogue between researchers and stakeholders to meet future challenges" European Commission
Brussels, June 10-11, 2013

RESILIENCE AND URBAN RISKS

IN MEGACITIES

Paolo Gasparini – *Professor Emeritus at University of Naples Federico II*

Scientific Coordinator of AMRA S.c.a r.l. (Naples)

Angela Di Ruocco – *AMRA S.c.a r.l (Naples)*

Domenico Asprone – *University of Naples Federico II*

amra
■ analysis and monitoring of environmental risk

Resilience

What is Resilience?

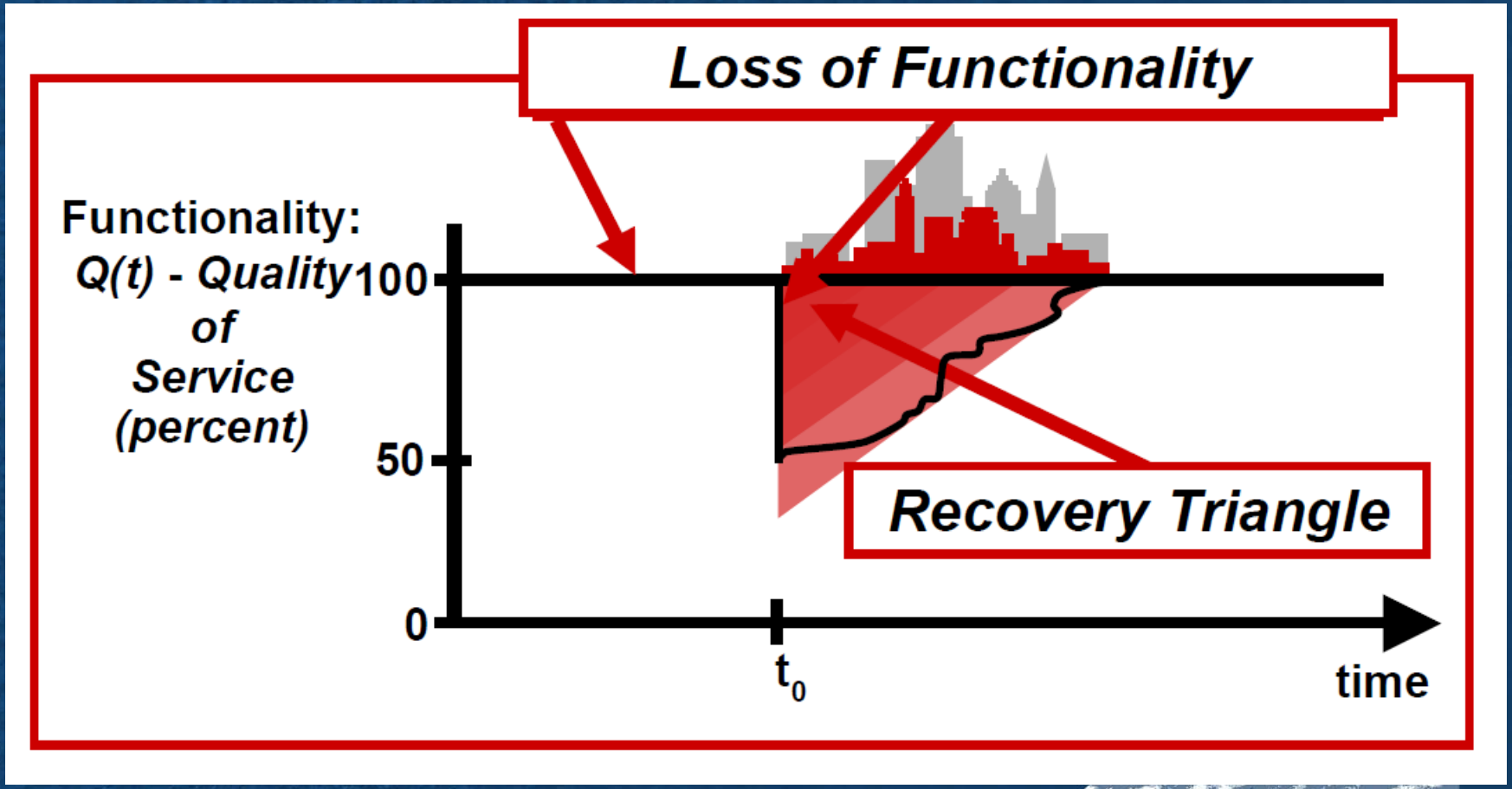
Resilience is an "ability to recover from, or adjust easily to, misfortune or change "

Resilience is the "physical property of a material that can return to its original shape or position after deformation that does not exceed its elastic limit"

1. Addresses ***functionality*** of either, communities, services, organizations, infrastructure, physical facilities, individually, or their combined interactions

2. Addresses both the ***loss of functionality*** (sudden in case of a disasters- earthquakes) and ***recovery*** (in time)

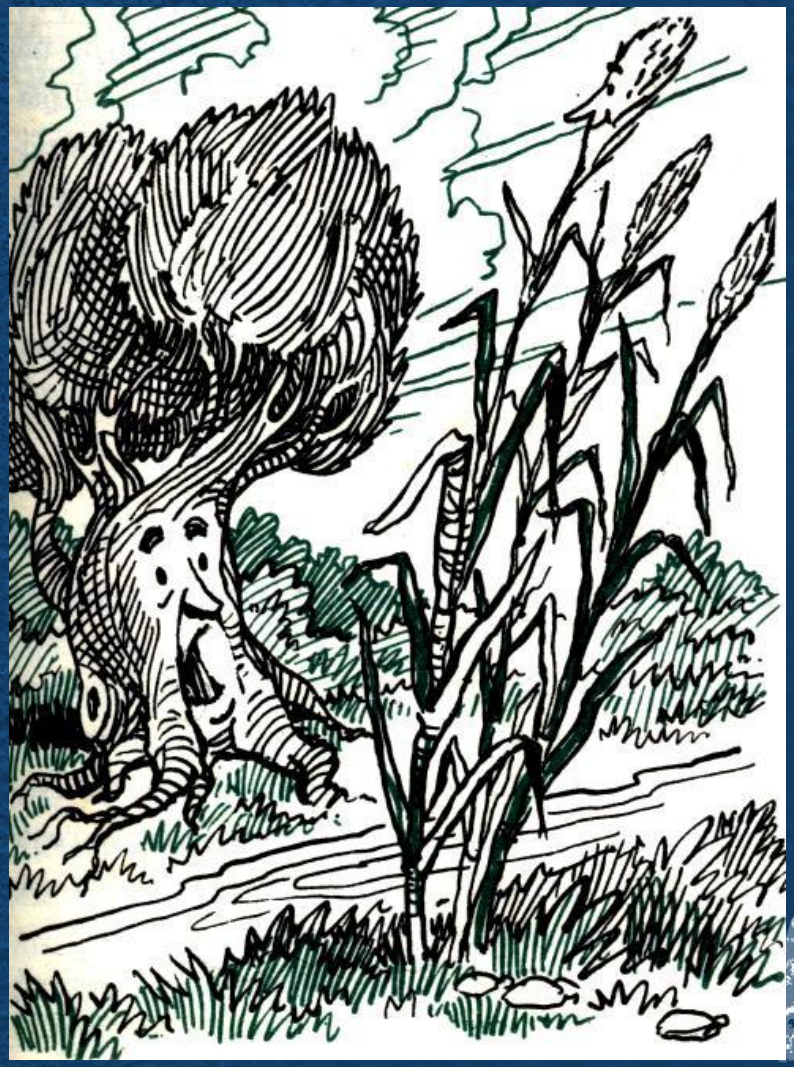
Reinhorn A. M., Cimellaro G., 2011



Reinhorn A. M., Cimellaro G., 2011

The terms “RESILIENCE”, “SOCIAL RESILIENCE”, “RESILIENT CITY”

- Resilience is beneficial to the system using it but may be harmful for other interconnected systems.



The terms "RESILIENCE", "SOCIAL RESILIENCE", "RESILIENT CITY"

- People's resilience or "social resilience" may undermine the city structure's resilience and deteriorate the whole city's vulnerability.
- What is "Urban Resilience"? How sensible is the term "Resilient City"?
- May a "Resilient City" be the habitat of vulnerable citizens? Do resilient communities and citizens translate into a "Resilient City?

- It has been assumed that a city that has been reconstructed rapidly after devastation from a disaster is a resilient city.
- The city of Tangshan is considered as highly resilient because after having been turned into a vast ruin by the earthquake of 1976, was rebuilt within 10 years, into a modern earthquake resistant city, with an improved quality of life, a source of pride for modern China.

Part of the Tangshan Earthquake Memorial Monument

The terms "RESILIENCE", "SOCIAL RESILIENCE", "RESILIENT CITY"

- Is it possible for a city which has been rebuilt from scratch to qualify a resilient city?

View of the New Tangshan after reconstruction

Or, recovery of **Tangshan** was due to the **resilience of the then new state regime** under Deng Xiaoping (after Mao's death) *"who forsaw the potential of using a rationally reconstructed Tangshan to show the outside world China's ability to modernize and to affirm the superiority of Deng's socialist regime over Mao's outdated leftist ideology?".*

The terms "RESILIENCE", "SOCIAL RESILIENCE", "RESILIENT CITY"

- The process of rebuilding alone is not enough for a city to qualify resilient in the recovery phase. What matters is who recovers, which aspects of the city and by what mechanisms (Vale and Campanella 2005).
- "Resilient City" is not simply a contested term, there is an inherent contradiction in the term: When one system (e.g. a household, institution etc) is resilient and recovers or avoids risk in the city, most probably some others experience increase of their vulnerability simultaneously or in the future.

Lifeboat: Resilient or vulnerable are the people inside?

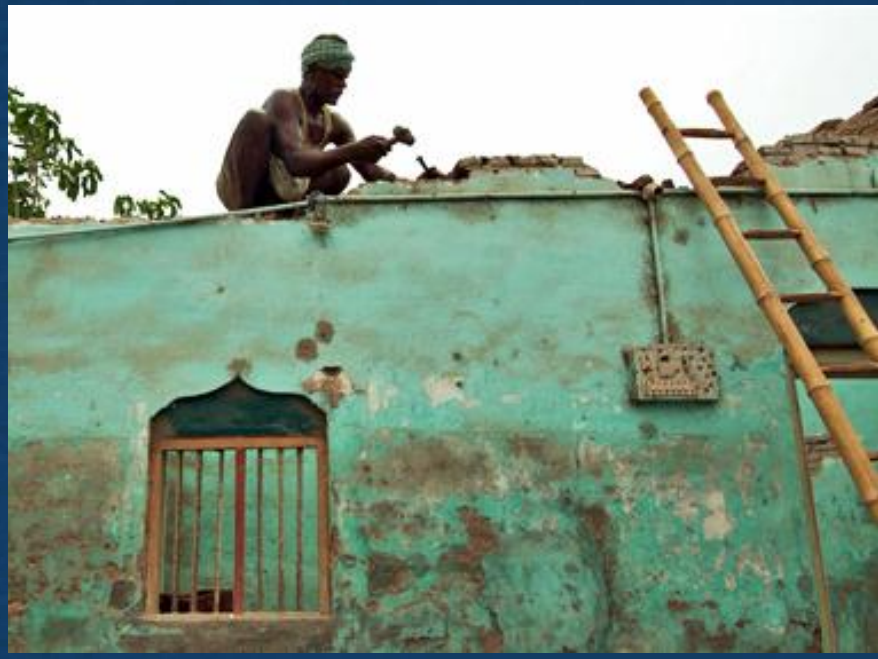
- **A city is resilient and vulnerable at the same time.**
- **This is because resilience is the trigger of vulnerability transferences, transformations, redistributions.**
- **No one can ever characterize a city as totally resilient or totally vulnerable.**
- **"Resilient City" is a misleading term.**

RESILIENT PEOPLE: DO THEY MITIGATE CITY's VULNERABILITY?

- There are **conflicts between individual and collective resilience, or causal relationships between individual resilience & collective vulneravility.**

- **People** usually **opt individual instead of collective.** It is for this reason that the wider urban structure does not improve in recovery periods.

- The preference of people to personal resilience has been confirmed in **Bam's reconstruction after the earthquake of 2003.** After pressures from the victimized groups, the IRCS introduced a cash voucher system to replace the distribution of relief items. This has enabled victims to acquire means for always more individual resilience.



The two phenomena influencing the future of cities

The wisdom of the crowd (Bettencourt and West, 2010)

The popcorn edge (Ezechieli, 2012)

The wisdom of the crowd: the rule of 15%

"…[If] the size of a city doubles, then, on average, wages, wealth, the number of patents, and the number of educational and research institutions all increase by approximately the same degree, about 15 percent…The bigger the city, the more the average citizen owns, produces, and consumes, whether it's goods, resources, or ideas." "However, the dark side of urban life manifests an analogous "superlinear" behavior. Doubling the size of a city increases wealth and innovation by about 15 percent, but it also increases the amount of crime, pollution, and disease by roughly the same amount."

Goeffrey West, University of Santa Fe, 2009

Considering the pros and cons, the crowd has decided that it is more convenient to live in increasingly larger cities.

The cities within 50 years

We live in exponential era!

For the 95 % of the popcorn's cooking time nothing happens…

In the last 5% everything happens!!!

The popcorn edge: the cities in the next 50 years

What do 50 years mean?

It is the time needed for babies to have our age…after all it will not take too long!

What did «50 years» mean in the past?

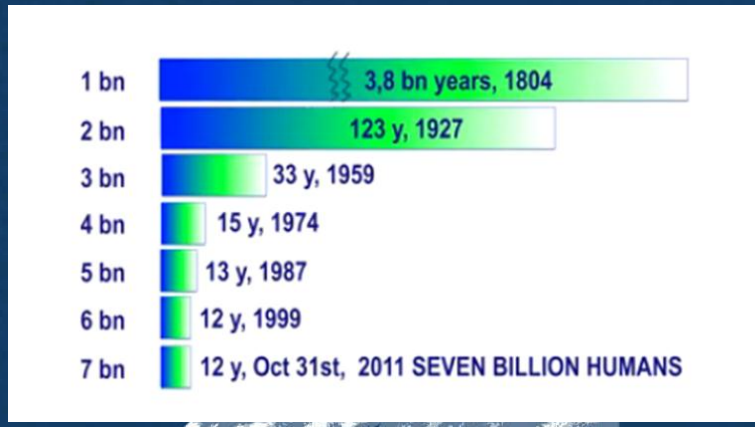
Before1898 no flight could have been imagined. In 1952 B52s had its maiden flight!

The cities in the next 50 years

We live in exponential era!

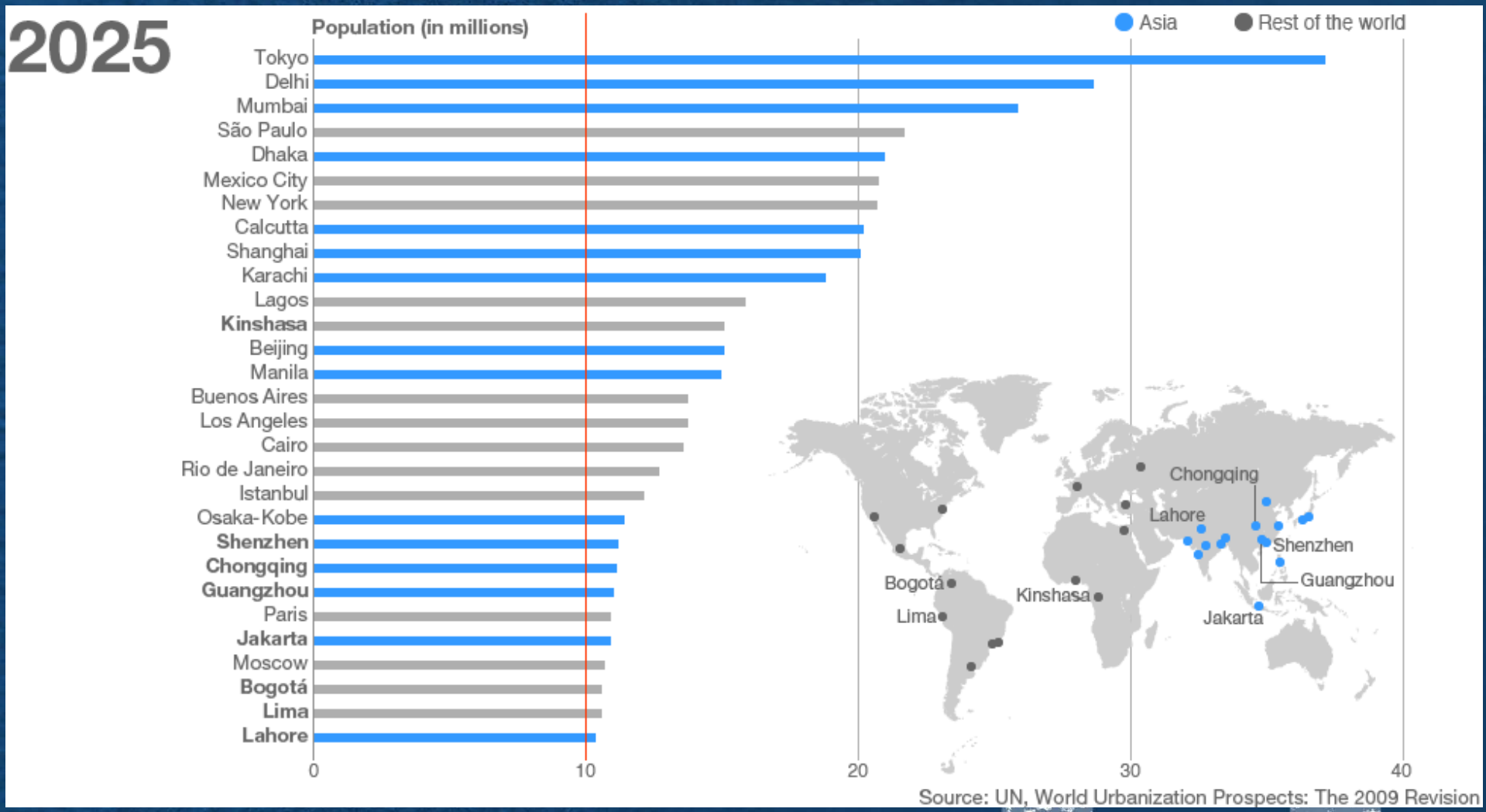
An example is the world population…

But it applies also to per capita GDP, technology, cities' population!



Megacities

- Cities with more than 5 millions inhabitants
- Large mega-urban regions encompassing several individual cities, such as the Ruhr area in Germany or the Randstad conurbation in the Netherlands (The Hague, Amsterdam, Utrecht and Rotterdam) with more than 5 millions inhabitants
- High concentration of value and infrastructures
- High level of global interlinking
- Close interconnection among flows of goods, finance and information.


2025
Population (in millions)
Asia
Rest of the world
Tokyo
Delhi
Mumbai
São Paulo
Dhaka
Mexico City
New York
Calcutta
Shanghai
Karachi
Lagos
Kinshasa
Beijing
Manila
Buenos Aires
Los Angeles
Cairo
Rio de Janeiro
Istanbul
Osaka-Kobe
Shenzhen
Chongqing
Guangzhou
Paris
Jakarta
Moscow
Bogotá
Lima
Lahore
0
10
20
30
40
Chongqing
Lahore
Shenzhen
Guangzhou
Bogotá
Kinshasa
Lima
Jakarta
Source: UN, World Urbanization Prospects: The 2009 Revision

Increasing Vulnerability

- Only 3 of the top 15 Megacities are in industrialized countries.
- Most of them are in less developed countries.
- In industrialized countries vulnerability of cities is increasing very fast due to the growing complexity of the whole system (lifelines, infrastructures, Information and Communication Systems, Supply chain)

MAIN NATURAL SOURCES OF URBAN RISK

Geological Sources (approximately constant with time)

- *Earthquakes*
- *Volcanic eruptions*

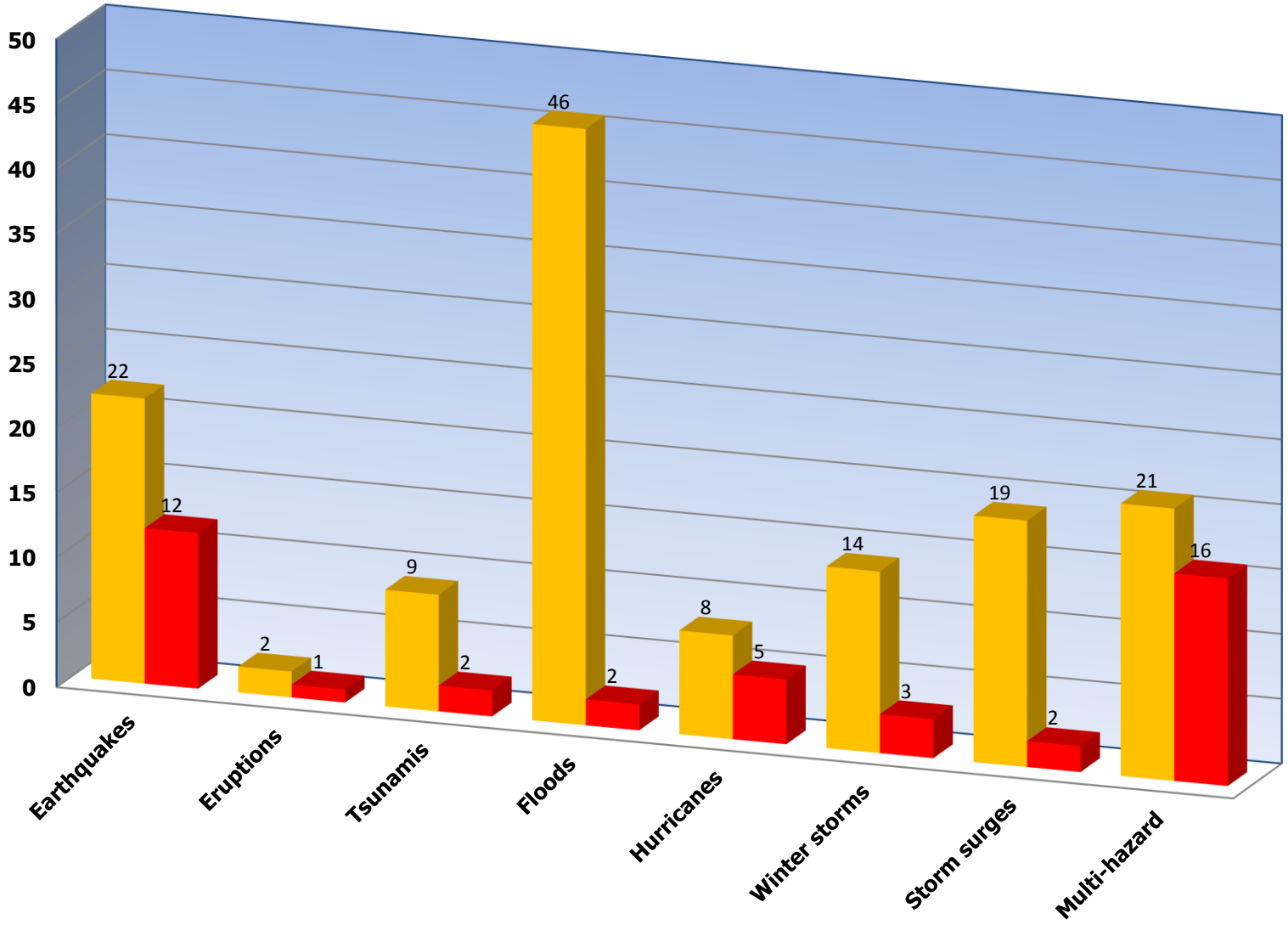
Sources originating outside and at the surface of the Solid Earth (Changing with time)

- *Mass movements (landslides, etc)*
- *Extreme weather phenomena (rainfall, wind storms. Heat waves,surges)*

Events triggered by Primary Sources

- *Tsunami*
- *Floods*

Natural hazards in 50 megacities



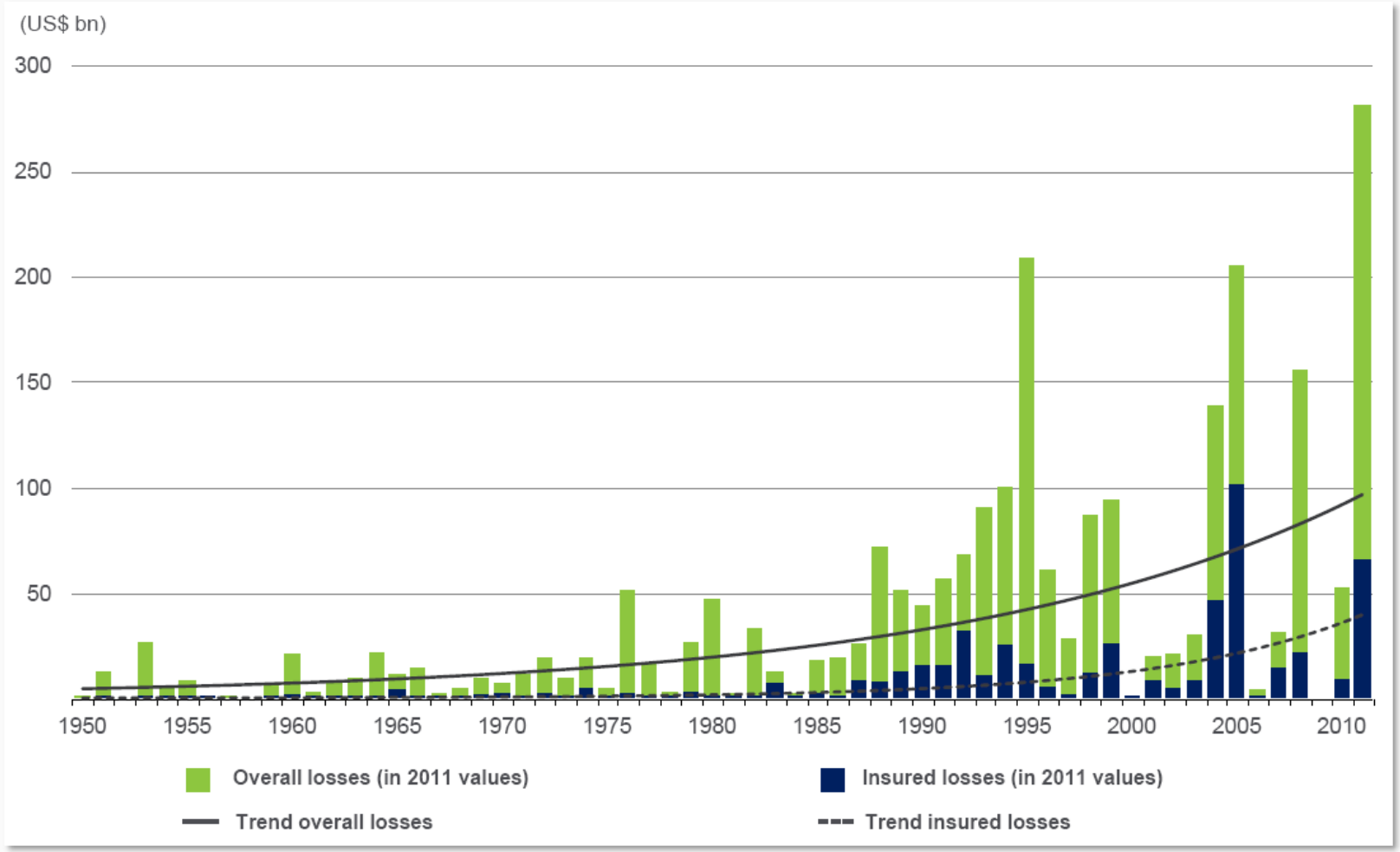
Source: Munich Re, 2004

NatCatSERVICE

Great natural catastrophes worldwide 1950 – 2011

Overall and insured losses with trend

Munich RE

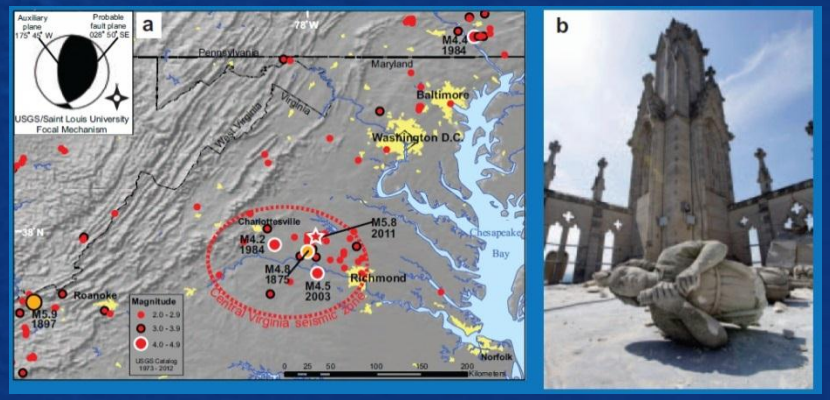


© 2012 Münchener Rückversicherungs-Gesellschaft, Geo Risks Research, NatCatSERVICE – As at January 2012

Disaster-related fatalities and damages are increasing

Emilia earthquake – May, 2012

Mw = 5.8



Virginia earthquake – August 23, 2011

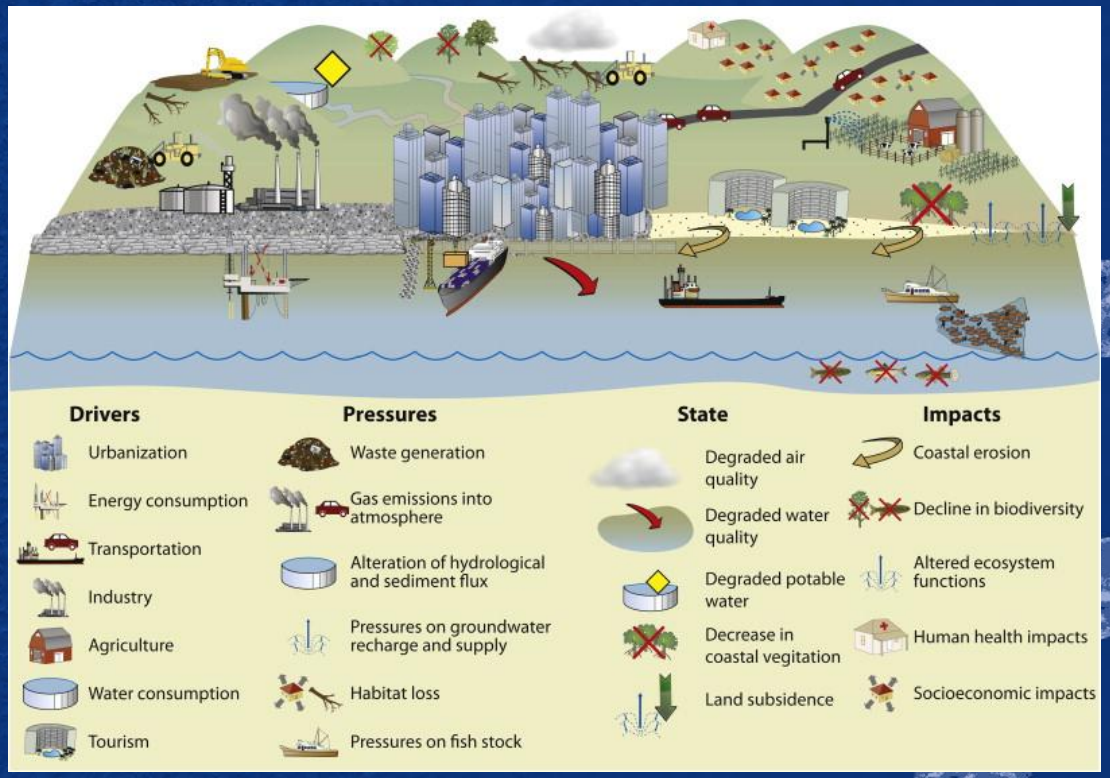
Mw = 5.8 – Damages in Washington, D.C. 135 Km away

Christchurch earthquake – February 22, 2011

Mw = 6.3

Weather and climate in Megacities

Megacities have their own individual city climate. On one hand, they influence the weather and are therefore a causative factor. On the other hand, the weather and climate in megacities have different effects to those in rural areas.



Black Swans

(Extremely rare events with huge impact on human life, structures, and socio-economy)

Tohoku Tsunami triggered by the unexpected Mw=9.0 offshore earthquake of March 11, 2011

Natural disasters and their effects on Supply Chain

Delocalization of productive processes all over the world exacerbates the supply chain risk, above all in cases of black swans.

Natural disasters effects can generate global consequences: a castrophic event in China, for example, "*would have far-reaching and long-lasting negative economic impact. It would slow down the global economy because China is not only a major exporter of goods, but also a major importer of goods*" (Vinod Singhal).

After the Japan earthquake and tsunami of 2011 Toyota spent six months for the recovery of plants, causing delay in the launch of two new car models and a loss in profits by over 30%.

How to minimize supply chain risk?

A resilient supply chain minimizes the impact of natural disasters

MYTHS AND DILEMMAS ON THE "RESILIENT CITY"

- Resilience is centered on self-priorities and self-capabilities.
- It is about selecting among hazard targets, vulnerability facet targets, allocating the selected targets in time and striking them according to own principles.
- Selected hazard and vulnerability targets (and available resources to striking them) differ from individual to collective agents.
- Private individuals struggle for their own opportunity to resilience by defending their livelihoods, especially durable income sources /land property assets.

The term "Resilient City" even as a long term vision is misleading. It is a term denoting that all components of a city can become simultaneously resilient, i.e. capable to cure their vulnerability.

"Resilient City" is an utopia because resilience and vulnerability co-exist, constantly reproduce one another. The two properties co-habit the urban system. A community of resilient citizens cannot ever become a non-vulnerable one.

MYTHS AND DILEMMAS ON THE "RESILIENT CITY"

- Resilient individuals may produce vulnerable communities and urban physical structures, i.e. collective vulnerability.
- Resilient governments may produce individual and social vulnerability.
- The slogan "Resilient City" equalizes the most and the least vulnerable in the city as regards their rights on resilience.
- Boosting of the resilience potential of some actors translates into increasing vulnerability of others. Resilience as a mechanism of vulnerability transference is generally beneficial for the initiating actor but may be harmful for others.

RESILIENCE IN MEGACITIES

The slogan "Resilient City" should be replaced by "RESILIENCE IN THE CITY". It rests with the urban community to prioritize between individual and collective resilience, through democratic processes

Megacities are Natural Risk attractors: how can we prevent them to become Risk Traps?

Recommendations for the future

- To promote resilience it is necessary to consider vulnerability of complex interconnected systems, including institutions, individuals and physical systems.
- Resilience should be continuously re-evaluated because vulnerability and risk have dynamic properties.
- To promote resilience it is necessary to consider all hazards encountered including extreme events, local impact of global hazards, and chronic damaging processes.
- Resilience must be integrated into sectoral policies and governance systems, including the removal of legal and regulatory obstacles.
- Resilience should be pursued through an integrated multi-scale approach both for communities and physical systems.
- Resilience should be pursued taking into account local culture, resources, built and natural environment and socioeconomic conditions.
- Disaster risk knowledge should be increased, as should the awareness and responsibility of how individuals and communities can contribute to resilience.

Recommendations for the future

- For effective risk management it is necessary to have community and individual participation.
- Resilience should be designed to be consistent with principles of social and environmental justice.
- Develop and implement improved quantitative and qualitative methods to measure and assess resilience for decision making, including consideration of uncertainties.
- Take advantage of all available technologies including social network systems and other low cost individual-based technologies.
- Take advantage of low-cost resilience tactics, at the individual business and household level, such as conservation of critical inputs, stockpiles, back-up equipment.
- Take advantage of formal and informal markets as potential sources of inherent resilience because they can provide signals of the value of remaining resources for efficient reallocation.
- Resilience can be strengthened by diversifying the supply chain.
- Successful local resilience experiences should be transformed into long-run adaptive practices.

THANK YOU FOR YOUR ATTENTION