FOR DRAFT NOT DISSEMINATION

Water Investments: Fundamental Social Means for Adapting to Climate Change and building Resilience in our Cities

From Concepts/Theory to Implementation

Keynote

For

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by

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Abstract

Since the dawn of human civilizations, societies have made water investments to deal with the exigencies of nature. Today most of the reasons world leaders and climate change community cite as to why we should be concerned with climate changes deal with impacts of water events such as sea level rise, floods, drought, tsunamis and more. Water Resources investments are at the heart of adapting to Climate Change.

Coastal areas will be most vulnerable on all scenarios due to sea level rises, ground subsidence and storm surges. At the same time, mega cities, mostly near the sea, continue to grow and most of the people on the planet will be living in mega cities near the coast. But: are we raising fears and anxieties over impacts of projected changes in climate while inadvertently denying means to cope with these impacts?

This raises many questions: What should be done? What levels of protection should we seek? How will we pay? Can we realistically talk of relocating cities? Based on selected worldwide and North America lessons,

This paper starts by setting a context with: 1 Public policy ethical reflection and 2 Analytical reflections. This is followed with reflections and lessons/recommendations for building resilience.

Introduction

Mayor Young-jin, Mayors, Colleagues, Ladies and Gentlemen, I am honored to address this distinguished gathering. Today I want to begin my remarks with one ethical reflection and two analytical reflections.

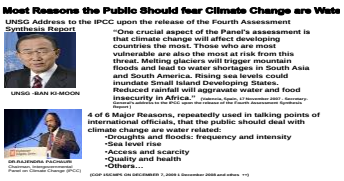
To begin: an ethical reflection:

Are we raising fears and anxieties over impacts of projected changes in climate while inadvertently denying means to cope with these impacts.

The major reasons repeatedly used in talking points of international officials, for why we should deal with climate change are potential water related events and their projected social impacts. (fig. 1). Indeed, a survey[1] by French Water Partnership (FWP) reports that 92% of Intended Nationally Determined Contributions (INDCs), part of the Paris COP21 agreements, submitted to the UN by 129 countries include water. The survey notes that water is the first priority noted for adaptation.

But as we focus the world's efforts on longer term mitigation we are spending little on such adaption and we may be denying people adaptive means to cope with these projected impact events.

Fig 1.



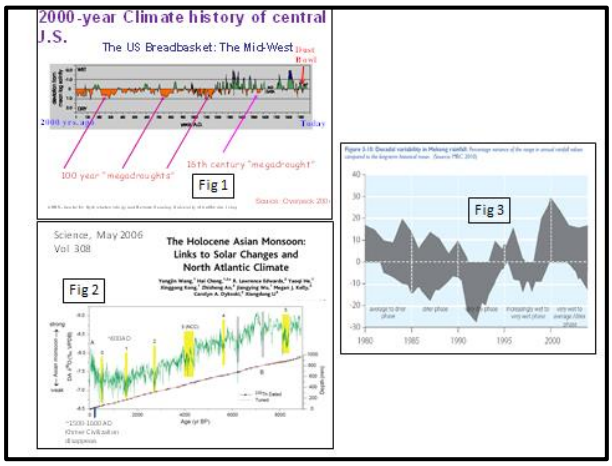
Analytical Reflection 1: Water Resources Investments are at the heart of adapting to Climate Change. Historical exploration of climate variability clearly shows how closely linked the professional water community needs to be to the climate change community.

Never the less the data on climate changes and water, precipitation and stream flow are still vague. For examples, the charts in Figures 2 show that:

- In North America droughts have pronounced multi-year to multi-decadal variability, but there is no convincing evidence for long-term trends toward more or fewer events.
- The Holocene Asian Monsoon is linked historically to solar changes and the North Atlantic climate over thousands of years.
- The decadal variability in Mekong rainfall over thousands of years.

[1] http://www.iwa-network.org/downloads/1448965142-2015%2011%2029_Review%20of%20Water%20integration%20in%20INDC_VF.pdf

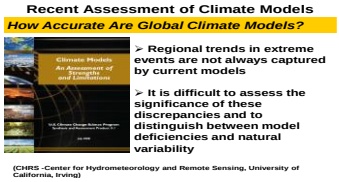
Figure 2



Climate variability and the key water related events stemming from such changes have always been with us. BUT regional trends in extreme events are not always captured by current GCM models and it is difficult to assess the significance of these discrepancies and to distinguish between model deficiencies and natural variability.

This leads some hydrologists to conclude that factoring in resiliency in water resources systems design and planning is still the safest approach.[2]

Fig. 3



If the academic and political communities are going to offer reasonable social impact assessments of projected climate changes we must encourage more cooperation between climate modelers and hydrologic modelers.

<u>Analytical Reflection 2:</u> Managing variability and risk, in water resources especially, is necessary to reduce poverty; break the fatalistic determinisms pervading

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[2] Soroosh Sorooshian, Center for Hydrometeorology and Remote Sensing, University of California Irvine, 2010 KEI International Water Symposium, July 20th, 2010 - Seoul, Korea

intergenerational memories, and; to create wealth by building platforms for growth.

From Theory to Policy: Selected Worldwide Context

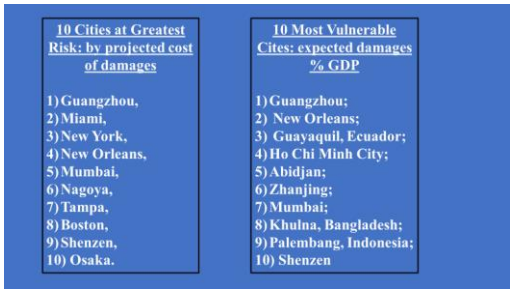
In their ongoing research of benefits and costs of adaptation measures for 23 cities worldwide Barraqué, and Tassin, note that that it is difficult to separate climate changes and other trends such as population growth, urbanizations. Like many others this is more or less aligned to analytical reflection #1.[4]

Their in-depth comparison of 4 cities in the Maghreb, Alexandria, Tunis, Algiers and Casablanca, shows high benefit cost ratio (at NPV) for DRR investment measures.[5]

However, the costs of investments to help people adapt are huge especially for low probability of events. Like many others, the authors note that politicians and the publics thus can have "short" memories and often do not take the threat sufficiently serious especially after events have come and gone.[6]

Based solely on socio- economic change, the World Bank projects average global flood losses to increase to US$52 billion by 2050. With new patterns of variability in climate and subsidence, protection must be upgraded to avoid losses of US$1 trillion or more per year. [7]

Fig. 4



The report projects that the cities at the greatest risk measured by costs of expected damages are: 1) Guangzhou, 2) Miami, 3) New York, 4) New Orleans, 5) Mumbai, 6) Nagoya, 7) Tampa, 8) Boston, 9) Shenzen, and 10) Osaka. The top four cities alone account for 43% of the forecast total global losses.[8]

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[4] "Adaptation to Water-related Climate Change in in cities," Bernard Barraqué, Bruno Tassin, July 2015, completed October 2015

[5] Op. Cit. Barraque et. al.

[6] Op.it. Barraque et.al.p.2-3

[7] Stephane Hallegatte, Colin Green,[3]Robert J. Nicholls & Jan Corfee-Morlot, "Future flood losses in major coastal cities," *Nature Climate Change* **3**,802–806, (2013)

[8] Stephane Hallegatte, Colin Green,[3]Robert J. Nicholls & Jan Corfee-Morlot, "Future flood losses in major coastal cities," *Nature Climate Change* **3**,802–806, (2013)

The report also lists the 10 most vulnerable cities when measured as expected damages as percentage of GDP as: 1) Guangzhou; 2) New Orleans; 3) Guayaquil, Ecuador; 4) Ho Chi Minh City; 5) Abidjan; 6) Zhanjing; 7) Mumbai; 8) Khulna, Bangladesh; 9) Palembang, Indonesia; and 10) Shenzen. And in most of these cities, the poor are most at risk as rapid urbanization has pushed them into the most vulnerable neighborhoods. At the same time protecting these cities in the future will take substantial investment in structural defenses, as well as better planning.[9]

According to OECD (2013) good adaptation strategies should focus on the range of risks crossing all aspects of water services**.** WHO notes that under extreme events, water and wastewater services systems stand to lose much of their environment and health benefits; for example, resultant contamination may be irreversible, and may affect areas beyond national borders. In short, IWRM is necessary for water adaptations investment. [10]

While studies of damages are growing, there is more analysis of damages due to floods then droughts. Beyond looking at post event damages there is little performance analysis of DRR investments in terms of damages prevented or avoided.[11]

World Bank data and the GWP -OECD water security report describe how GDPs can vary with rainfall. Zimbabwe, Ethiopia, Kenya and Mozambique data suggests that variations in GDP due to the inability of dealing with variations in rainfall (the peaks and lows of the hydrograph, floods and droughts) might account for almost 25 -30 % of variations in GDP.[12] The International Water Management Institute (IWMI), in 2009, notes that Ethiopia's limited ability to cope with droughts and floods are estimated to cost the economy one-third of its growth potential.[13]

It seems that water DRR and infrastructure investment brings damages as a percentage of GDP to roughly 5% levels in the rich world as opposed to around the 25-30% often estimated in the poorer world. Means to flatten the hydrograph must be taken to avoid accelerating the discrepancies between the poor and rich.

The Institute for Water Resources (USACE Figure 5) shows a relationship between the Human Development Index and Damages as % of GDP. It also shows a movement of the transition countries toward the upper left.

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[9] Op. Cit., Hallegate, et. al.

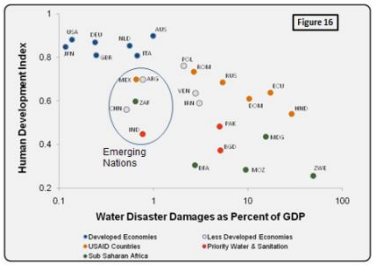
[10] **Guidance on Water Supply and Sanitation In Extreme Weather Events,**Edited by L Sinisi and R Aertgeerts UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE and WHO Europe, Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark,E-mail: contact@euro.who.int, Web site: www.euro.who.int

[11] "Adaptation to Water-related Climate Change in in cities," Bernard Barraqué, Bruno Tassin, July 2015, completed October 2015

[12] David Grey[12] and Claudia W. Sardoff, Sink or Swim? Water Security for Growth and Development, Water Policy, 2007,

[13] (IWMI, Water Policy Brief, Issue 31, 2009)

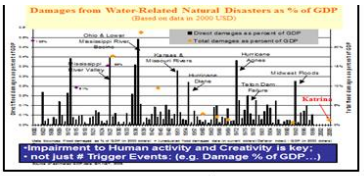
Figure 5

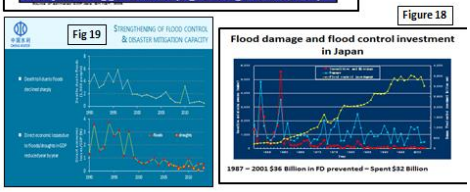


USACE IWR 2010

Figure 6 shows that while damages may increase in the U.S, investment in water DRR and infrastructure to deal with variability has resulted in decreased damages as percentage of GDP in the U.S. Figures 7 and 8 paint similar pictures for post war Japan and modern China. They capture some of the interactions between the two dynamic systems; nature and humans. As the index - damages as percentage of GDP - lowers it also is an indicator of increased resilience; resilience to allow the social systems to continue functioning even under the stress of large scale natural events.

Figures 6,7,8





From Theory to Policy Implementation: Selected cases

> In August 2005, the World watched Katrina devastate New Orleans, 1.2 million people evacuated; 1.5 million displaced; nearly 1,500 people died; direct property losses of over $20 billion; about $5.6 billion in infrastructure losses; more than triple from any previous disaster in the New Orleans area.

ASCE studies noted failures to see that the sum of many parts did not lead to a HPS system-wide approach to design or operation. The result was changing technical configurations, rising costs, project extensions, and unclear mixing of cost sharing interests and technical considerations between state, local and federal entities.

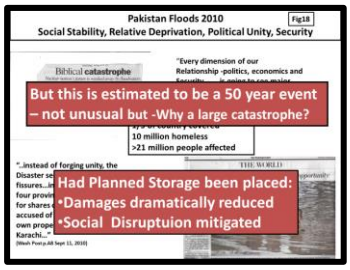
In the positive vein, in late summer of 2011 the Mississippi River reached some of the highest recorded levels in US history. This was managed through the Mississippi River and Tributaries (MR&T) project which was constructed over the last 70 years.[14]

The 2011 event was close to the size of the historic 1927 event which paralyzed about two thirds of the U.S. By contrast in the 2011event over 4.0 million people in numerous medium sized cities as well as rural areas were protected. The 80-year MR&T realized $478.3 billion in flood damages prevented which means that it had a large positive return on public investment. It's authorization legislation in 1930s specifically also included "room for the river."

A similar story can be seen in the performance of the three Gorges Dam in the Yangtze floods of 2011; especially regarding mega cities downstream of the dam,

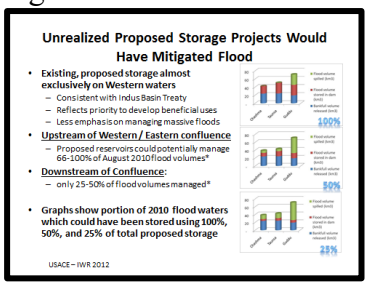
Tragically the non-attention to water infrastructure investment resulted in significant losses in the Indus floods of that period. One fifth of the country was covered. Ten million people were left homeless and more than 21 million people were affected. The four provinces and several cities were engaged in cut throat battles for shares of flood aid money and flood refugees stream to the city Karachi.[15]

Figure 9



Pakistani/U.S. post flood studies by the Institute for Water Resources showed that proposed storage could potentially have managed 66-100% of August 2010 flood volumes.

Figure 10



While some have seen the Indus flood as an indicator of climate change most hydrologists see it as a less than an extreme 50-year event. What happened? Over the years, socio-economic

[14] (USACE, MVD, 2012, Post 2011 Report).

[15] Wash Post p.A8 Sept 11, 2010)

activities increased with little attention given to adaptive investments to help manage large events. If this situation is repeated worldwide; one may ask, what will happen if larger scale extreme events occur?

In October 2012, One hundred seventeen people in the U.S. were killed and 650,000 homes were damaged or destroyed along East Coast and NYC by super storm Sandy. Damage estimates for the NJ – NYC area alone exceeded $60 billion.

Sandy alerted the U.S. to the growing challenges of climate variability and urban design. Figure 11 depicts how Manhattan would look with an additional 5 ft. or so of sea level rise, plus the 13 foot storm surge from Sandy. Assessments revealed, there was significantly less damage and social disruption from hurricane Sandy, around those areas with existing hurricane shore protection projects.[16]

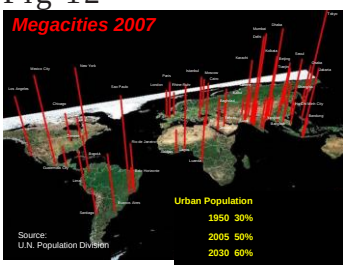
Figure 11

The third National Climate Assessment (NCA) for the U.S., May 2014, noted:
The nation's economy, security, and culture all depend on the resilience of urban infrastructure systems. How will New York City and other coastal cities prepare for this type of inundation? As we speak the devastation in Florida, Huston, the southern U.S., and South Asia all continue this wake up call.

Some Emergent Lessons:

1. We must better plan for prevention in the growing mega-cities around the globe and not just view them in terms of humanitarian post-disaster responses.

Fig 12



2. Mega-cities will require more infrastructure investment together with appropriate nonstructural measures like land-use controls, zoning, and regulations to avoid increases in damages.

[16] Water Related Disaster Risk Reduction (DRR) Management in the United States: Floods and Storm Surges, Water Policy, By Jerome Delli Priscoli and Eugene Stakhiv[16]

3. Estuaries and wetlands perform valuable services such as dissipating storm surge impacts and more. There is broad consensus, that we must increase efforts to re-nourish and restore their functions.

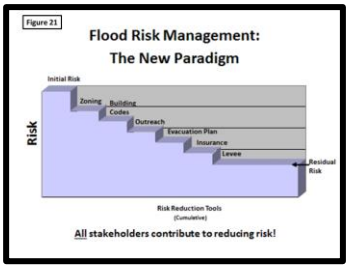
4. We need better early warning systems and to increase the people centered flood warning as dissemination and communication critical.

5. Since absolute safety is not possible, we must find ways to minimize effects when and if project designs are exceeded.

6. The positive relationships between managing uncertainties of extreme water events, economic development and social well-being are critical.

7. **R**esidual risk is almost always underestimated because it is difficult to quantify a cascading series of highly interdependent measures, each of which has its own reliability characteristics and risk of failure.

8. Because people bear the risks, their involvement in choosing risk levels and participation in the tough operational decisions made during the process of planning for mitigation of potential events is critical to the health of a democratic system.
Fig 13



9. Multiple defenses are critical. This means creating packages of natural and human processes such as evacuation routes, elevated and flood-proofed buildings, pumping stations, levees, flood gates, highways, natural ridges, wetland nourishment, barrier islands, outer shelf activities and compart- mentalization of polder areas

10. Hydro meteorological data needs public access and to be shared.

11. More data on benefits and costs of DRR investments and more performance data on damages prevented of existing DRR measures is needed worldwide.

Conclusion

Ladies and Gentlemen:

United Nations (UN) Water notes, “Adaptation to climate change is mainly about better water management.” Thus: Water investments must be key parts of any adaptation strategies or mechanisms negotiated around climate variability.

The world is taking note: e.g. hundreds of mayors have now signed on to the WWF Istanbul Consensus on Sustainability in Cities. The GWP urban programs in Africa are heeding the UN SG's HLP on Water Related disasters recommendations and integrating DRR into Urban SD planning.

The heart of this Urban SD paradigm is that more than preserving or restoring we are actually jointly designing our ecology – our home – with nature.

Thank you