A plea for putting the issue of Urbanizing Deltas on the New Urban Agenda, UN Habitat III

Meyer, Han; Peters, R; Kuzniecow Bacchin, Taneha; Hooimeijer, Fransje; Nijhuis, Steffen

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A plea for putting the issue of

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on the New Urban Agenda

Delta Alliance / TU Delft

Han Meyer, Renske Peters

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Urbanizing Deltas – a special challenge

Summary
Urbanizing deltas belong to the most promising regions of the world, considering their large concentrations of population, their role in the world's ecosystems and their significance to the world's economy. At the same time, these regions are dealing with extreme vulnerability and face multiple threats. The combination of intensification of urban and economic land use, the related disappearance of the deltas' capacity to resist natural hazards, and climate change, are resulting in an increase of deadly diseases, poverty and substantial economic losses.
To ensure a sustainable future in these areas, new strategies are necessary to improve the living conditions for all people in delta regions and to decrease their risk level. Successful strategies are possible if they focus on (1) the recovery of the formative power of the deltas and the capacity of land-water ecosystems to absorb the impact of extreme events and their resilience to restore balance after disturbances; (2) an inclusive approach to planning by integrating scientific research, engineering and design, and combining interventions concerning prevention, spatial adaptation and disaster management; (3) the possibility to combine adaptation and mitigation of climate change by developing new perspectives with low carbon footprints for ports and industrial areas; (4) capacity building and social inclusiveness; (5) multi-actor governance arrangements with smart financial mechanisms.

I. Introduction

In the framework of the attention of Habitat III to the processes, consequences and challenges of worldwide urbanization, the question of urbanizing deltas needs special attention.
Deltas are the areas where rivers flow into seas or oceans; delta territories have been produced by the dynamic forces of seas, rivers and climate. The complex, interactive processes of river discharges, sea waves, tidal currents, sediment transport and deposits, wind, temperature and vegetation are the driving forces of land formation.[1] Deltas offer excellent conditions for economic development and urbanization, but are also the regions with the highest risks for people, planet and profit.

- *Deltas are magnets for economic development and urbanization.*
  Historically, deltas played an important role as birth places of urban settlements, because of their position the crossroads and transshipment point of international trade, and because of the fertility of alluvial plains and the estuarine and coastal waters, which makes deltas attractive for agriculture and fishing. At present, deltas are magnets for urbanization and economic development more than ever. In 2050, ca 650 million people will live in delta and coastal urban regions.
  Deltas function as magnets because of the excellent conditions for economic development and human settlement at the transition of water and land: deltas are strategically positioned for trade and commerce and equipped with fertile soils and waters. In many nations, delta- and coastal regions are the engines of the national economies with the highest contributions to national GDPs.
- *Deltas are places of increasing flood risk, water scarcity, ecological and economic damage.*

[1] Bradshaw, Weaver, 1995

These same conditions generate a growing risk for flooding, resulting in increasing numbers of victims, severe economic damage and ecological downgrading.
Greater concentration and densification of urban land use has resulted in the disappearance of natural land-water transitions, which are important as buffers in times of high water levels and natural disasters. Increasing flood risk is a consequence of this disappearance of delta territories' natural resilience capacity and is reinforced by sea level rise caused by climate change.
Land subsidence as a result of intense drainage and groundwater extraction increases the vulnerability of urbanized as well as rural areas, often dropping below mean sea level.
Between 1980 and 2013, the global direct economic losses due to floods exceeded $1 trillion (2013 values), and more than 220,000 people lost their lives.[2] It is expected that populations vulnerable to flooding by storm surges will multiply tenfold or more over the 21st century and this will affect an estimated 100 million people each year.[3] Floods in urbanizing deltas have disastrous impacts on the economy as well as on the ecology of entire countries. As a consequence of flooding, local and national economic activities are disrupted for a long time, leading to a substantial decrease in GDP. The 2015 World Economic Forum (WEF) Risks Report has put the impact of Water Crises as the number one global risk.[4]
The high risk for flooding, heat stress, water shortages and poor air quality, resulting in increasing amounts of socio-economic impacts; huge economic losses, increasing amounts of lives at risk and severe ecological down-grading or impacts on natural capital. Worldwide the impact of climate change, if adaptation is not taken place, is expected to grow to 500 billion or 1 trillion US Dollars a year by 2050 (World Bank, 2013).
Because of increasing flood risk and flood hazards, mass migration to deltas and coastal areas can quickly turn into the reverse – which is already the case in some areas. Floods in New Orleans (2005) and east Japan (2011) resulted in the departure of many people who never returned.

- *Towards new perspectives for urbanizing deltas*
  In the next 15 years we have the window of opportunity to generate inclusive development (WRI, 2015): huge urban infrastructure investments (e.g. 75% of India cities needs to be 'infrastructure'), extreme weather events in the short term, gradual climate change impact in the mid term, a need to compete between cities, huge demographic changes (e.g. 1 billion Africans move to delta cities).
  Therefore, the challenge is how to combine sustainable economic utilization of these regions with a substantial improvement in the quality of life for all social groups through interventions for decreasing risks and repairing the resilience capacity of delta territories. Urbanizing deltas offer excellent opportunities for smart combinations of adaptation and mitigation, for example, by lowering the risk of flooding by decreasing greenhouse gas emissions. Implementation of smart combinations of adaptation and mitigation will result in more sustainable economic growth and more sustainable, resilient and safe delta territories, ultimately delivering a higher quality of life for all social groups.

We propose an action agenda for UN-Habitat, with eight action points linked to priorities for urbanizing deltas:

1. *Restoring delta regions' natural resiliency and adaptability.*
2. *Towards an integrated approach of land use planning: integrating scientific research, spatial planning, design and engineering.*
3. *Climate Change and Flood Risk policy: towards combinations of and smart tools for prevention, spatial adaptation and disaster management*

[2] Winsemius et al. 2015
[3] Nicholls et al. 2007
[4] WEF 2015

4. *Sustainable port and industrial development: combining adaptation and mitigation*
5. *Sustainable agriculture: diversification*
6. *Social inclusiveness and community building in spatial planning and design*
7. *Multi-actor governance: public and private involvement*
8. *Financial means: developing creative financing mechanisms*

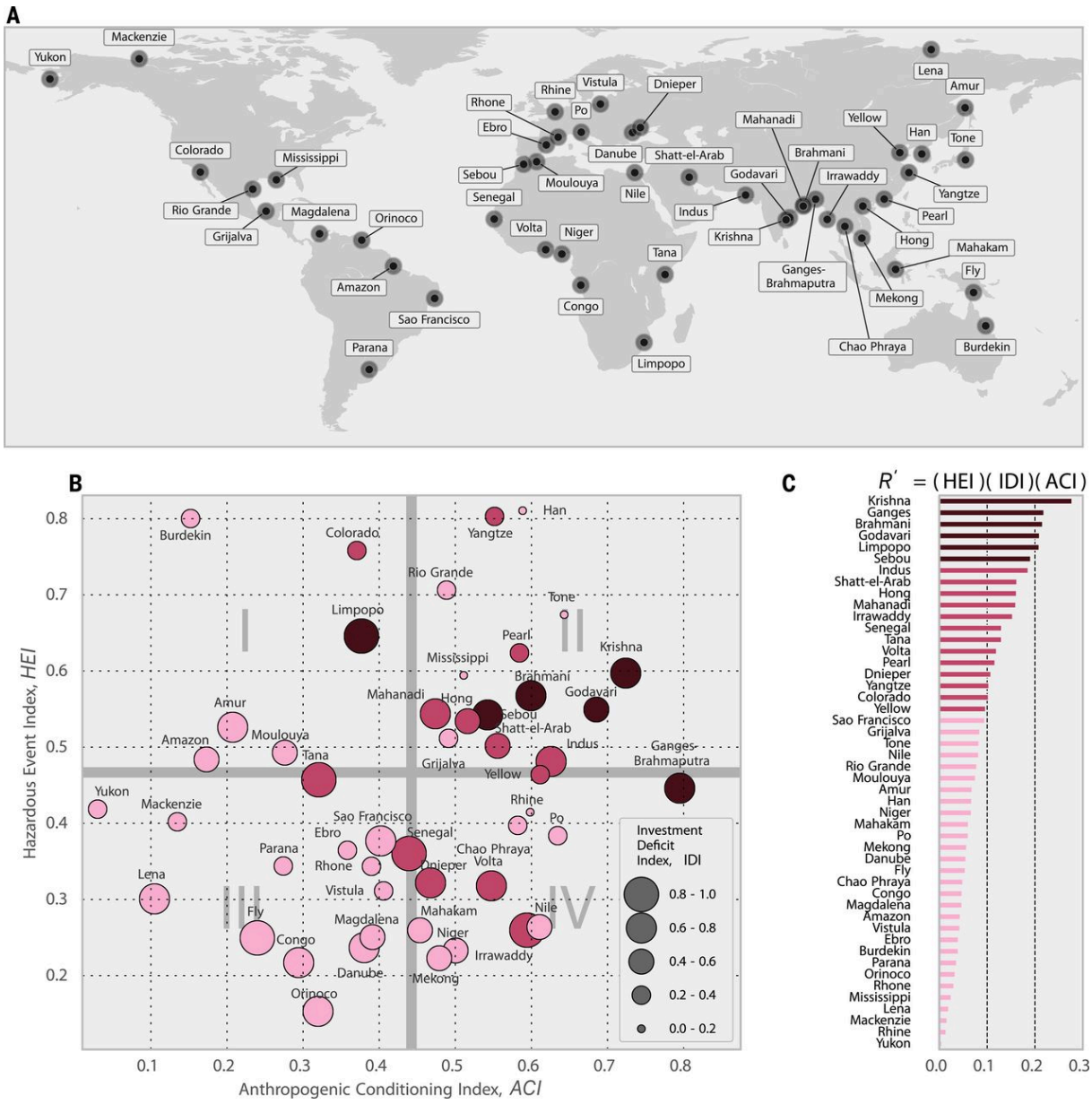

Figure 1.
Risk trends for deltas worldwide. (**A**) Map showing the 48 deltas included in a study by Tessler et al., 2015. (**B**) Phase diagram of contemporary risk assessment results, showing the three component proxy indices used to estimate per-capita *R′*. Color density represents a delta's overall risk trend. Quadrant III deltas have predominantly low *R′*, whereas quadrant II deltas have high *R′*. (**C**) Estimates of the relative rate of change in risk, or risk trend, for each delta due to increasing exposure associated with RSLR. The Krishna and Ganges-Brahmaputra deltas, despite being only moderately susceptible to short-term hazardous events, are increasingly at risk because of high rates of RSLR and high socioeconomic vulnerability. Ganges-Brahmaputra is abbreviated to "Ganges" in some panels for brevity.
Source: Tessler et al. 2015

II. Agenda for Action

1. **Restoring the natural resiliency and adaptability of the deltas**.

Challenge

A delta is the product of the convergence of one or more rivers and the sea, which results in a dynamic process of sediment deposition and erosion. Dependent on the formative power of sediments transported by river, tidal currents or waves, we can distinguish river-dominated deltas, wave-dominated deltas and tide-dominated deltas.[5] All these different deltas have in common the fact that they contain the richest ecosystems of the world, with the largest amount of ecosystem services.[6] The gradual transitions between land and water and between salt and fresh water are the biotopes and nurseries of many species that are crucial for the ecological balance of the world's rivers and oceans. Next to the ecological value in terms of biological productivity and diversity, the ecosystems have significant economic value via ecosystem services such as: coastal protection, maintenance of fisheries and wildlife, erosion control, water catchment and purification, carbon sequestration, nutrient cycling, tourism, recreation, education and research.[7]

The depletion of the natural system of deltas by human interventions has led to:

a. Decrease of the formative power of the deltas through dramatic losses of the ecosystem services. Intense urban and industrial land use, drainage, dredging, reclaiming and damming have deprived the land-water ecosystems of their capacity to absorb the impact of extreme events and their resilience to restore balance after disturbances. Moreover, because of upstream damming and reservoirs, the sediment resources in rivers have been substantially depleted, causing serious erosion of delta and coastal landscapes.[8] In their research on 40 deltas around the world, Ericson et al. show that sediment trapping is the main cause of erosion in 27 of these 40 deltas.[9]
b. Land subsidence, caused by intense drainage and (industrial use of) groundwater extraction. As an outcome, urban and agricultural territories in many deltas (including the Nile delta, Rhine-Meuse delta, Mississippi River delta, Jakarta, etc.) have dropped substantially below sea-level, making these territories more vulnerable to flooding. This process is still going on in many urbanizing deltas, leading to uncontrollable flood risk.
c. Increase of salinization, caused by the combination of intense dredging, land subsidence and sea level rise, and resulting in a shortage of freshwater supply. Many urbanizing deltas find themselves in a paradoxical situation: surrounded by water, but lacking *fresh* water, leading to problems including a lack of drinking water and water for irrigation.

Priorities

It is necessary to revitalize ecosystem services and their capacity to contribute to the recovery of delta territories after disturbances. This revitalization must occur in many of the natural land-water transitions: beach and dune systems, salt marsh systems, coastal coral reefs and mangrove forest systems.

In the long term, 'building with nature' delivers the conditions for delta regions to adapt to climate change continuously, by using the formative power of nature as the strategy's foundation.

We can distinguish three types of 'building with nature' policies and interventions:

[5] Bradshaw and Weaver, 1995
[6] Costanza et al. 1997
[7] Barbier et al., 2011; de Groot et al. 2012
[8] Mulder et al. 2010; Campanella 2014
[9] Ericson et al. 2006

a. *Maintenance* of existing gradual land-water transitions; reconsideration and revocation of plans to transform these zones for urbanization or economic exploitation;
b. *Repair* of disappeared land-water transitions and related water systems. For instance, the state of Louisiana plans to restore several river distributaries in the lower Mississippi River Delta by re-introducing sediment deposits in the delta wetlands. A second example is the introduction of 'green-blue infrastructures' to create continuous and sustainable groundwater levels (see also Action 2: Land use).
   The beneficial re-use of dredged sediments is also part of a strategy to repair land-water transitions (see also Action 4: Sustainable port and industrial development).
   Alternative solutions for freshwater and energy supply in upstream regions are important to repair sediment transport to the deltas via rivers.
c. *New measures* to equip the coastline with additional material, which can be integrated in the natural system. An example is the 'sand engine' on the Dutch coast: a man-made island of sand, which will be distributed along the coastline – resulting in a structural enhancement of the shoreline.
   Another important issue is stopping ongoing land subsidence by rethinking drainage as a main policy to deal with storm water management and minimalize industrial use of groundwater.

Because of the historically developed dependency of most urbanized deltas from civil engineered solutions, mixed solutions should be taken into account of 'soft/green' and 'hard' engineering. (see figure 1).

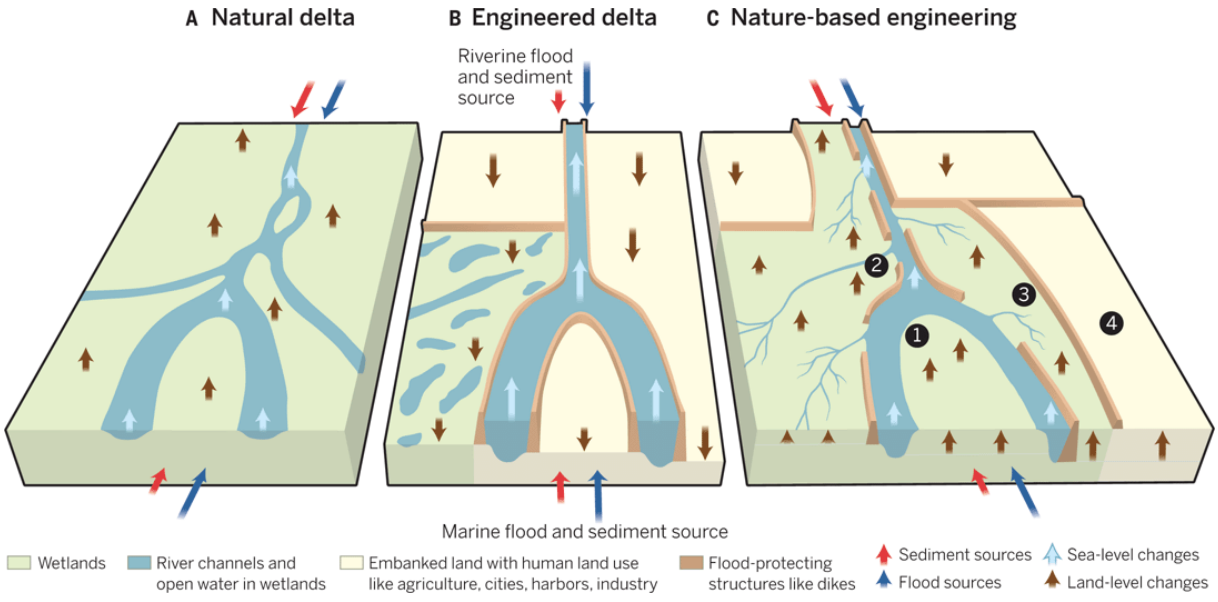

Figure 2.
Sinking or rising deltas:
In natural deltas (**A**), land can rise in balance with sea level through sediment accumulation in regularly inundated wetlands. In deltas with conventional engineering (**B**), land rise through sedimentation is prevented by flood-protecting structures like dikes and upstream river dams; land sinks due to human activities like soil drainage, and extreme water levels rise due to loss of wetlands. As Tessler et al. show, reliance on conventional engineering of this kind poses a risk to populations living in deltas around the world. In contrast, we propose that nature-based engineering solutions (**C**) can help to maintain land-building processes and flood storage through wetland conservation and restoration, for instance by dike removal (1), controlled dike breaching and river diversions (2), and temporary dike breaching and subsequent re-embankment (3, 4).
Source: Temmerman, Kirwan, 2015

2. **Towards an integrated approach to land use planning: integrating scientific research, spatial planning, design and engineering**.

Challenge

Ongoing densification and transformation of urbanizing deltas is possible but requires clear regulations. Because of the complex character of soil, as well as the possibility to combine sustainable flood-prevention strategies with stimulating new economic development and creating new social balances, planning is very closely related to (and dependent on) scientific information, design and engineering.

'Building with nature', stopping the processes of land-subsidence and salinization, and the possibility to combine these ambitions with new economic developments and social inclusion, requires a well-organized balance among science, planning, design and engineering.

It is important to be aware that three different scales are strongly linked with each other: The scale of the *drainage basin* of the river(s), the scale of the *delta* and the scale of *local interventions.* Deltas are dependent on the water and sediment supply from the rivers, which can be trapped by upstream interventions (like hydropower dams, freshwater reservoirs, canalization and deforestation). In return, interventions in the deltas like dredging and damming can lead to ecological downturn in upstream areas and salinization. Communication and negotiation between planning authorities in the drainage basins and delta regions is essential to ensure a delta's sustainable future.

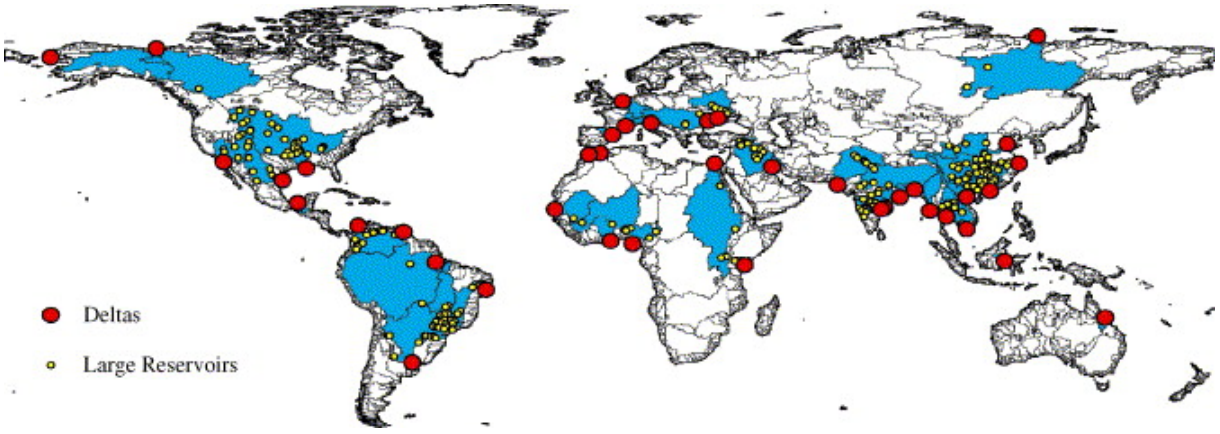

Figure 3
Global distribution of 40 deltas, the potentially contributing drainage basin area of each delta (blue) and the large reservoirs (> 0.5 km^3 maximum capacity) in each basin.
Source: Ericson et al. 2006

Priorities

- Working on the sustainable future of urbanizing deltas requires an approach that combines long term and large-scale planning with small-scale projects that can be implemented on the short term. Plans and Projects should be considered as two linked and parallel pathways of a sustainable, 'learning-by-doing' planning approach. Projects need to be evaluated and monitored so the results can be continuously used to specify or modify overall plans.

- In several deltas, agricultural over-exploitation leads to downgrading of the delta. Developing new economic perspectives in non-farm sectors is essential. An example of this strategy can be found in the World Wildlife Fund's delta vision for the Indian Sundarbans.[10]
- Green-blue infrastructures are important elements of land use planning in urbanizing deltas: spatial frameworks for combinations of long term water- and nature-sensitive urban environments with short term economic and social initiatives. Open spaces in urban areas (wet, dry and vegetated), provide alternative design possibilities for synergies among nature, infrastructure and users. They provide a new balance among the maintenance, storage and discharge of storm water, resulting in a stabilization of groundwater levels and stopping the process of land subsidence. Moreover, these infrastructures and the process of their design have been proved to play a key role in urban revitalization, economic development and community-building. Successful examples of green-blue infrastructures can be found in Boston, Philadelphia, Singapore and Rotterdam.

3. **Climate Change and Flood Risk policy: towards combinations of and smart tools for prevention, spatial adaptation and disaster management**

   Challenge

   Because of uncertainties concerning the exact effects of climate change on sea level rise and peak discharges of rivers, it is necessary to develop an adaptive and flexible approach that is able to accommodate future uncertainties.

   An effective approach to enhance the resilience of urbanizing deltas has to combine the focus on flood prevention with taking into account the possibility of flooding.

   Priorities

- *Prevention by building resistance and resilience*.
  Robust prevention measures will still be necessary in most delta areas. However, they should be combined with approaches that extend the resilience capacity of deltas by 'building with nature' as much as possible. Examples of this policy can be found in the *Room for the River* and *Weak Spots Coast* programs in the Netherlands, in the proposals for restoring the wetlands of the Lower Mississippi River Delta and in the *Rebuild-by-Design* proposals for New York.
- *Spatial adaptation*
  Being prepared to moderate floods means spatial adaptation by special facilities in the built environment (buildings as well as public space), to limit the consequences of flooding as much as possible. Vital functions in the urban fabric such as facilities for energy supply, health care and public and private transport should be especially safeguarded from flooding.[11]
- *Disaster management*
  Being prepared for extreme floods means the availability of evacuation routes, accessible evacuation sites and trained first-aid and emergency teams.
- *Capacity development* of local policy makers and local population in terms of adaptation and disaster management. (see also action point 6).
- *Awareness raising* among the population, early warning systems, safe heavens, and recovery plans. In all with particular attention for the poor people.

[10] Danda 2011
[11] Van Wijngaarden 2015

4. **Sustainable port and industrial development: combining adaptation and mitigation**

Challenge

Urbanizing deltas are not only victims of climate change but also *contribute* to climate change through their functions as important centers and transportation hubs of fossil fuel-based economies with large greenhouse gas emissions[12]. The world's largest centers of trans-shipping, storage and fossil fuel processing are situated in deltas; the economy of these delta regions is thus largely based on trans-shipping, storage, processing, financing, accountancy and insurance of fossil fuels.

The transition to more sustainable energy sources will greatly impact urbanizing deltas. Reorganizing ports and industrial plants combining adaptation (new types of land use with attention to ecology and flood defense), mitigation (substantial reduction of greenhouse emissions) and developing new initiatives for a circular economy and energy transition will be a major challenge in the future.

The role of urbanizing deltas in the world's economy and ecology can change in a radical way: from being the crucial hubs of the old fossil fuel-based economy, urbanizing deltas can become the engines of a new, clean energy-based and circular economy.

Moreover, the development of ports and navigation channels are a critical factor in urbanizing deltas. Dredging in estuaries and rivers has a high impact on upstream areas, leading to higher tidal fluctuations, salinization and flood-risk in these areas.

Priorities

- The reorganization of land use in urbanizing deltas should focus on the combination of adaptation and mitigation, by transitioning the regional economy from a fossil fuel-based economy, resulting in coastal squeeze, to a clean energy-based economy that also generates space for sustainable land-water processes.
  The development of ports and navigation channels can be considered a critical factor in such a strategy to enhance the resilience of the deltas.
- New concepts and policies for the location and lay-out of ports and cargo transport to upriver destinations are a major priority. As an example, the Port of Rotterdam, in collaboration with the World Wildlife Fund, is developing a new concept in *The Port of the Future*. This concept will be implemented with local stakeholders and citizens, in order to contribute to the environmental and social resilience of the urbanizing delta. The concept is also being explored in Ghana.

Figure 4.
A 'Port of the Future', maintaining the natural system of the delta as well as accessibility for shipping and port traffic. Source: Deltares 2015

[12] Hein 2009

- In developing countries, inclusive economic development is a precondition of sustainable development. Local economic development is a high priority, especially as urban deltas are engines of national economic growth. City Development Strategies have to balance between economic, social and ecological policies. It is important to identify win-win situation, such as sustainable ports. However, it is equally important to support inclusive governance arrangements and capacities in order to set priorities.

5. Sustainable agriculture: diversification

Challenge

Deltas offer a richness of fertile soils and waters, and play a central role in the world's food production. The fluvial plains of deltas offer very fertile soils for agriculture; in fact, some delta regions are also the most productive agricultural centers of the world.[13]
This role as a main food supplier is under great pressure because of both increasing urbanization and climate change impacts (e.g. water shortages, heavy rainfall). However, for the future supply of the world's population in general and for the increasing number of inhabitants living in deltas in particular, maintenance and improvement of their food production role is crucial.

Priorities

- A proper balance between agricultural, urban and industrial land is important. In many cases, uncontrolled urbanization leads to a dramatic loss of agricultural land as well as to mass vacancies of buildings and building sites.[14] Preventing a total urbanization of delta regions is also necessary for the maintenance or restoration of the absorption capacity of the delta territory during extreme weather conditions. Agricultural land can play a substantial role as part of a strategy to reinforce the flood-resilience capacity of the delta.
- Agriculture in deltas should address ongoing processes of salinization.
  Diversification, such as the growth of mixed rice-and-fish farming in the Mekong delta, makes agricultural areas less vulnerable to fluctuations in the international market, as well as to changing physical conditions in the delta (such as the increase of saltwater intrusion during periods of low river discharges).[15] Experiments with brackish and saltwater agriculture are currently being developed in several delta regions and should be encouraged.
- Transport routes between agriculture production areas and urban areas are often lacking because of the speed of urbanization. These routes need to be prioritized and improved.
- Agriculture needs to be adapted to changing weather and climate conditions and needs to be transformed into Climate Smart Agriculture (CSA).

6. Capacity building and research: extending knowledge on why, what and how

Challenge

A major challenge is the development of long term planning strategies based on short term projects using smart combinations of flood prevention, ecosystem repair and economic renewal. To this end, prior to the start of the designing phase of each project the involvement and participation from the very beginning of local stakeholders and citizens, well-trained professionals and academics in sciences, planning, design and engineering is crucial.

[13] The Netherlands is the second largest exporter of agricultural products in the world; Vietnam is the largest exporter of rice in the world, largely due to the agricultural potential of the Mekong delta.
[14] Chen 2004; Du et al. 2013; Murray et al. 2015
[15] Beng 2002

Scientific knowledge is necessary concerning the physical qualities of the territory and of biotic and abiotic processes, as well as societal, demographic and economic processes. This means that knowledge input is required from a wide variety of different scientific disciplines, from ecology and biology to hydraulic engineering, urban planning and design, economics and social sciences. Advanced information technologies like Geographic Information Systems (GIS) and Remote Sensing can help to detect the most relevant processes and qualities of the territory.

Not 'one-size-fits-all': Many deltas suffer from similar problems, however the solutions for each delta are specific and unique. Every delta has is its own characteristics and potentials for its development. Deltas can be classified based on several indicators:

- the coherence of biophysical aspects;
- the dominating economic activities;
- population: density, culture and social life;
- land use patterns, urban forms and networks;
- governance structures and financial means.

The combination of these indicators can serve as a basis for delta-specific strategies for sustainable urban development.[16]

The exchange of knowledge among urbanizing deltas contributes to discussions of best practices regarding design, planning, engineering and governance. This in turn leads to greater knowledge and capacity development.

<u>*Priorities*</u>

- *A global transfer and exchange of knowledge* is necessary and, in some respects, already happening. From this perspective, the key issue is that huge amounts of knowledge and data are already available to worldwide researchers. However, local experts and professionals often are not aware of this availability, or are not able to find the right data. Therefore, it is essential to facilitate data collection, modelling and real-time monitoring of deltas to strengthen the knowledge base.
- *Delta city wide organisational capacity* is needed. At least 9 competences are needed to built the capacity needed: 3 strategic competences (awareness, agency, leadership), 3 developmental competences (agents of change, working together, learning attitude), 3 operational competences (program management, scope and coherence, knowledge and expertise). The capacity level needed to transform will be high and all competences need to be at this level. If one of these competences is not at high level, breakthrough projects will not take place.
- *Involvement of actors outside academia.* The complexity of governing the challenges associated with deltas requires an agenda going beyond transfer and exchange of knowledge. There is an emerging agreement that sustainability challenges require new methods of knowledge production and decision making. One key aspect is the involvement of actors from outside academia in the research process in order to integrate the best available knowledge, reconcile values and preferences, as well as create ownership for problems and solution options.[17] Action-oriented co-creation of transformation knowledge requires an intense dialogue with local practitioners, also involving the local knowledge provided by local residents, farmers and fishers concerning their territory. These stakeholders can play a crucial role in translating general and abstract facts and figures into meaningful stories, which can lead in turn to responsible decision-making within the territory as well as to broad societal support for plans and projects. Thus, the accessibility of information, knowledge and technology is crucial to support planning, design processes and actions developed by local authorities, citizens, entrepreneurs and NGOs.

[16] Nijhuis & Pouderoijen, 2014
[17] Lang et al,. 2012

- Using advanced *decision support systems.* Examples of interactive knowledge and planning systems that communicate between advanced data systems and local knowledge, are featured in *The Port of the Future*,[18] as well as the *Delta Envisioning Support System*, (*DENVIS*, originally developed in a research project in the Rhine-Meuse delta and currently being applied in the Ganges-Brahmaputra delta in Bangladesh).[19]

7. Social inclusiveness and community building integrated in spatial planning and design

Challenge

The speed and scale of the current human migration to coastal and delta areas is unprecedented and creates high risk for extreme social inequality. Marginalization and exclusion become realities for large groups of people. The consequences of increasing flood-risk especially affect the population with the lowest income, often recently arrived in the city and living in areas that were not previously urbanized – often because they are the most vulnerable areas of the deltas.

The informal spatial organization of these neighborhoods and weak building construction are often reasons behind the relatively large amount of urban poor victims.

Next to the danger of drowning, floods result in mass health and scarcity problems, disproportionately affecting the urban poor[20].

What makes the problem of the urban poor in delta areas special, is the lack of risk-awareness. Social inclusiveness should start with a strong policy to inform and communicate with the population concerning the increasing risks of the area.

Building sustainable and resilient urbanizing deltas means that strategies for flood prevention and ecological repair should be based on involvement of people living in the most vulnerable areas and lead to a higher quality of life for all social groups.

An inclusive delta approach would create conditions to make the ecosystem services of delta areas beneficial for poverty alleviation. The *Ecosystem Service for Poverty Alleviation in Deltas* project is an example of this strategy.[21]

Priorities

- *Information and communication* with all people living in urbanizing deltas concerning risks and vulnerability;
- *Effective citizen engagement* for the identification and prioritization of projects is necessary to ensure that actions are based on a shared vision and meet the needs of all citizens. The inclusion of civil society and the private sector in the implementation of activities means that there is likely to be greater 'ownership' of these interventions, and that they will be maintained and protected more effectively, in part because the capacity of various actors will be strengthened to take proactive measures. If citizens perceive interventions as contributions to their wellbeing they may be more likely to be directly involved in the implementation and maintenance of ecological and resilient projects, potentially generating cost savings.
- *Grassroots-driven disaster risk reduction* should not only be a right for affected communities, but also demanded by governments. Engaging women, indigenous people and other marginalized groups can strengthen local development and disaster risk reduction efforts, making them both more transparent and effective from the bottom up. The entry point for social inclusion is the priorities of vulnerable communities themselves. One sided, top down

[18] Deltares 2015
[19] Meyer et al 2015
[20] Wisner et al. 1994
[21] **www.espadelta.net**

solutions, such as a unilateral focus on flooding, will not create local ownership nor empower vulnerable groups. This demands inclusive governance, whereby top down and bottom-up planning meet.

8. Multi-actor governance: involvement of public and private partners

Challenge

Urbanizing deltas are extremely complex systems that are difficult to govern. The speed and scale of urban and economic growth in these regions often exceed the capacity of the traditional public authorities in delta regions to direct developments in a proper way. Uncontrollable urbanization (+ expansion in flood-prone areas) leads to dramatic loss of agricultural land, putting pressure on food production and other environmental services. Local actors are the primary agents in local development, disaster risk reduction and disaster response. Especially, women are often marginalized from decision-making processes. Poor communities tend to face a combination of livelihood challenges, environmental hazards and social hazards such as street crime. The overall risk is greater than the sum of its parts. Social hazard, for example, can undermine local capacity to organize itself in order to reduce public health or natural and climate hazards, as well as being hazardous and undermining quality of life in its own right. A clear challenge for those at risk and with responsibility for urban planning and risk management is to identify interactions between multiple forms of hazard and vulnerability, and to identify those members of society who are most vulnerable. It makes little sense to reduce one form of risk while another (potentially more serious) risk is not addressed.

Priorities

We recommend designing systematic and ongoing public participation processes and to consider establishing high-level expert panels to support the growth of a strong governance framework.

Many of the necessary activities that need to be implemented to enhance the resilience of urbanizing deltas depend on the existence or creation of such an appropriate enabling framework.

Priorities concerning governance and management include:

- *Cross-boundary coordination* among national, regional and local authorities. Delta regions are part of the watersheds of rivers, which often cross regions and national borders. The enhancement of the resilience of urbanizing deltas thus requires communication and coordination among different authorities and institutions at the national, regional and local scales. Where rivers cross different national territories, the international scale should also be involved.
- *Integrated approach*. Urban planning and design, economic policy, social policy and hydraulic engineering each engage complex problems that require focus and attention. However, the public institutions responsible for these domains often work autonomously, without any coordination in-between. Successful coordination among spatial planning, flood risk management and economic and social policies is essential to reach the goals described in the previous paragraphs.
- *Controlling urban sprawl and stimulating compact cities*. What rules and regulations for real estate development (also given the problems of land subsidence?
- Rapid urbanization/ flooding etc. will often go hand in hand with *rapidly rising land prices* + speculation + new needs for land registration (shifting land uses, new usersgroups etc.).
- Changing land use (as a consequence of urbanization + floods) will often lead to land conflicts (competing claims) and new need for conflict resolution.

- *Inclusive governance*. Involvement of citizens, the private market and NGOs is necessary for two reasons: First, local residents, farmers and fishermen have great knowledge about specific qualities and characteristics of the territory and the possibilities for dealing with these characteristics. Second, a long term sustainable and resilient urbanizing delta is only possible if it is based on a framework of broad societal support, contributing to community-building and a balance of power. Long term sustainability is not only a matter of technically smart solutions, but also *and especially* of the social and cultural embedding of the approach.

9. Financial means

Challenge

Making urbanizing deltas more resilient will mean financial expenses for new interventions and measurements. The expenses will be high in many cases, but the benefits will be much higher:

- effective prevention of flooding leads to reduction of costs for compensation of the damage, cleaning and reconstruction of flooded areas, as shown in several studies;[22]
- higher investments from private companies result in higher revenues for public taxes. The CPB Netherlands Bureau for Economic Policy Analysis calculated that the annual benefits of the Dutch Delta Works are four times more than the annual costs (annual write-off of investments and annual maintenance).[23]

An effective and creative policy concerning financial issues should take the local circumstances very carefully into account. From this perspective, it is necessary to reconsider some of the programs of global financing institutes like the World Bank and development banks, who sometimes use criteria and assessments that preclude funding for 'building with nature' solutions.

Priorities

- As part of the governance framework, especially as part of the coordination and agreements among national, regional and local governments, *special funds are necessary* for investments to enhance the resilience capacity of urbanizing deltas. These investments should be considered as pre-investments, which will lead to larger benefits in the long term.
- *Long term strategies are necessary.* Resilience-enhancing investments can grow step-by-step. Starting with relatively small investments to improve flood-prevention by enhancing resilience will lead to new private investments, which will in turn afford new tax-revenues. This will enable public authorities to increase public investments in a second round, etc. Integrated approaches might seem difficult at first sight, but deliver great added value over the long term (in terms of efficient land use, innovative solutions, and financing).
- *Smart combinations* of flood prevention measures with other economic developments can substantially reduce the costs of flood prevention. New creative financing mechanisms need to be developed, for instance by introducing special 'resilience tax' systems for travelers, tourists and developers in delta regions.[24]

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