REMOULDING TOPOGRAPHY

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ABSTRACT: Bangladesh is currently facing food and water shortages. The productive landscape, that makes up 60% of the country, is no longer able to satisfy the increasing food and employment demands. In the search for employment opportunities and a better future, a mass exodus from the under-serviced rural areas results in a rural-urban migration, which only contributes to enlarging the urban slum population. With a focus on the Southwestern area of Bangladesh, particularly around Khulna City, this paper investigates the spatial issues and potentialities of the region. Through a reading of the territory, with attention to the crucial status of water, topography. shifting urbanism and r-urban dispersion, this paper attempts to explore, what next?
KEYWORDS: R-urbanity, topography, urban migration, urbanization, water purification, cut and fill, Bangladesh.

1 UN-BALANCED COEXISTENCE

The constant presence of soil and water in different gradients characterises the Bangladesh landscape. Transformed by human processes over time, this extensive productive waterscape is now experiencing several paradoxes. Firstly, despite the abundance of water[1], as the world's largest delta, formed by the alluvial deposit of Ganges, Brahmaputra and Meghna, the lack of potable water is creating health hazards. This is primarily due to arsenic contamination, seasonal decreases in ground water levels, and excessive salinity in coastal regions. Water pollution is also very high due to industrialisation, agricultural fertilizers and corruption in water management. The country is experiencing a critical water crisis, where 170 of 230 rivers are polluted and water management is poor. Monsoons and the resulting floods are no longer able to re-balance the water quality resulting in continued exploitation of fresh ground water[2].

For centuries, floods and droughts have presented constant problems in the country, but recently, due to climate change they are more frequent and cause more damage. In 2004, two thirds of the country was devastated, and 30 million people were affected by one of the worst floods in history. Natural disasters are further aggravated as water borne diseases are easily spread due to the poor condition of the sewerage and drainage systems. Only after the tsunami in 2004, was the crucial role of the Sundarbans mangrove forest as a natural breakwater, more clearly understood. Unfortunately, the rise in the water level due to climate change, and the water salinization due to the shift from rice paddy to more lucrative shrimp farming, are directly affecting the survival of this natural protection. According to Prof. Hazra, by 2020 another 15% of the Sundarbans' habitable area will be lost, displacing over 30,000 people. Moreover, mangroves are not only extraordinary carbon dioxide absorbers, but also fundamental in stabilising shores and trapping sediment. This is very significant in a land-starved country such as Bangladesh.

At the end of the rainy season, water recedes leaving a heavy deposit of silt, which naturally enriches and fertilizes the soil, improving the productivity of jute and rice fields. As part of this siltation process, the flood plain topography is constantly changing, in turn reducing water conveyance capacity and the navigability of drainage channels. Water pollution and mismanagement worsens the topographic conditions. Riverbed erosion, due to excessive destruction of natural vegetation, and siltation, also contribute to the drying up and change in courses of rivers. Consequently, rivers have been silting up rapidly in the last decades and only 175 out of 230 rivers still exist, most of them with a meandering flow. Having lost their

[1] The annual water availability is 771,400 cubic metres, nearly 3 times the world average.
[2] Mahamudul Haque, M., "Nor any drop to drink," The Daily Star, www.thedailystar.net (2008).

initial carrying capacity, the rivers cannot absorb the rainfall, resulting in damaging floods, which affect human beings and agriculture.

As a partial consequence of hydrologic and geo-morphologic conditions, agriculture is the largest land user (61%), the largest source of employment (80%) and the largest water user (86%). Paradoxically, in 2005 the Health Survey estimated a food gap of 2.4 million metric tons under the 25.7 million metric tons of food grain required. Producing only 2.4 kg per ha, Bangladesh occupies the top of the rice shortage list in South Asia. Despite the intense riverine system, the annual total water withdrawal is approximately 73% from groundwater and only 27% from surface water and due to overexploitation during the dry season, ground water resources are rapidly depleting[3].

One of the most critical problems facing Bangladesh is the large population, currently approximately 153 million, with about 1090 people per sq km[4]. Therefore, the shortage of water, food and land availability becomes even more dramatic. Even if the population is still concentrated in the rural areas (83%), rural-urban migration is a predominant phenomenon, symptomatic of problematic rural conditions. Dreaming of a better future, people move from the under-serviced rural areas towards the already congested and under-equipped urban areas where there is a severe lack of water supply, sewerage, drainage and mobility systems. Vast economic resources will be needed to address the current situation. The resultant mushrooming of slums is obvious, with an estimated 5.4 million people, making up 35% of urban population[5].

These problematic aspects of the local context highlight the imbalance in the coexistence of natural and human processes. The maintenance and the management of soil and water have become more essential than ever, to address the food shortage, to provide safe high land, and to develop the local economy. Furthermore, it is evident that there is a need for a stronger socio-economic and spatial structure to support the rural areas. The already congested urban areas cannot sustain this rapid urban growth. Therefore, it seems that some form of counterbalancing of the rural-urban migration, possibly by improving services and social infrastructure in the rural areas may be necessary.

2 THE CRUCIAL ROLE OF TOPOGRAPHY

The waterscape of the JKM Region[6] is composed of an intense riverine system, water fields and water ponds. This complex system works as drainage, irrigation and water storage for productive aquaculture. The riverine system intensifies towards the Sundarbans in the south, the main ecological attraction of JKM Region. Due to soil and topographic conditions, the water table is generally high, from less than one metre in the rainy months to fifteen metres in the dry months. During the rainy season, the water table is between one and three metres and good aquifers are found between 18 and 46 m. In the rural areas, for an emergency supply of good drinking water, there is a program to sink a hand-pump for every 200 people[7]. Flowing downstream the water deposits sediment along the river ledges, thus generating higher land, safe from normal floods, on which settlements of different densities takes place. The flux of water adding and subtracting soil constantly moulds the landscape. Located along the rivers edges and taking advantage of the sediment deposits, numerous brick factories characterise the landscape of this region. 'The clay is the basic material found in the delta (…). The malleable and ubiquitous clay can be moulded to form simple enclosures, or can be burnt to produce bricks or terracotta, which is part of a struggle to congeal the fluidity of the deltaic material into something solid and durable'[8]. A peculiar characteristic of the Bengali architecture-urbanism is the coexistence of the permanent and the impermanent in the deltaic landscape. As Ashraf notes, clay translates the 'contradictory desires for solidity and permeability' as malleable soil and as solid brick.

On different gradients from urban to rural, the logic of the water directly determines the way this floodplain is inhabited. Taking advantage of the Bhairab River as a waterway, the linear city of Khulna

[3] Data source: FAO Statistical Yearbook, Country Profile, http://www.fao.org, 2004

[4] Data source: World bank, World Development Indicators, 2005.

[5] Centre for Urban Studies, National Institute of Population Research and Training, Measure Evaluation, "Slums of Urban Bangladesh," Dhaka, Bangladesh, USA, Chapel Hill, 2005, p. 35.

[6] The JKM region refers to the studied area including Jessore, Khulna and Mongla.

[7] Rashid, H.E., "Geography of Bangladesh," Boulder, Colorado, Westview Press, 1991, pp. 69-70.

[8] Ashraf, K.K., "Wind Water and Clay. The Architecture of Bangladesh," in 'Pundranagar to Sherebanglanar, Architecture in Bangladesh', Dhaka, Chetana Sthapatya Unnoyon Society, 1997, pp.9-10.

developed along its edges. Here, the mushrooming of industrial activities isolates the water's border, making it an impermeable edge to public access. The profound relationship between city and river is obvious where trading and processing take place. Outside of the city, dense rural settlements occupy the edges of smaller rivers, taking advantage of the higher river ledges. Densely populated yet scattered within the territory, these rural settlements are inherently linked to the rice paddies, upon which their survival directly depends. Thus, the waterscape plays a crucial role in determining the nature of agricultural and water-based society. The intense water system constitutes the geographic structure of this water-based society.

Living with water, Bengalis have developed a complex indigenous tradition of water management. Kamal points out how this water knowledge has been partly lost during the colonial period with the shift from community-based to technologist-government based water management. Referring to Willcocks´ studies, he explains the importance of the overflow irrigation system. By cutting the banks of the canals, the water would expand into the agriculture fields, whilst after the flood these cuts were closed. The maintenance of this system was community-based, under supervision of the landlord (*zamindar*). During the colonial period, the British did not understand the subtle indigenous knowledge, which led to their closing and reinforcing the riverbanks to prevent flooding. Instead of taking advantage of the water – giving it space – their system accelerated its flow out to the sea. The agricultural prosperity of the pre-colonial period based on an efficient management of flood and irrigation has not been achieved again since then, not even after the British departed. Today, despite the water management programs, large number of canals and rivers are silted up and the government seems not to have learnt from the colonial experience. The overflow irrigation system together with river dredging introduced during by the Mughal rulers, are without doubt important indigenous practices which should be taken into serious consideration[9].

In this relatively flat waterscape, the subtle topographic difference of a few centimetres plays a crucial role in determining conditions; wet and dry, productive and inhabited land, and in times of flooding, safe and unsafe. Therefore, topography represents the main infrastructural tool. Maintaining enough space for water percolation and providing highland for human settlement becomes crucial. In digging a pond, the soil extracted is used to create the base of safe highland where one constructs a house. The water which can not percolate through the soil, because of the building, can now be stored in the water pond for the dry season, thus, water ponds counterbalance homesteads. This mechanism of 'cut and fill' is essential to maintain the balance between human and natural processes. Designed to fulfil mainly the demand for drinking water, the pond has always had many purposes, including bathing, washing and fish farming. Even after the late 1960's when the government provided huge incentives to introduce tube wells, ponds remain the main source of drinking water in rural areas[10]. In a different way in the urban context, their function and presence are often denied, and bought cheaply to be filled with ground to build on, spelling the end of many urban ponds. Together with the abandoned indigenous water practices, this tendency is a sign of a lost sensibility in balancing the amount of permeable and impermeable surface. Today, the water management issue has become secondary to large investment infrastructure projects.

3 SHIFTING URBANISM

Since the post-colonial period, attention has moved from the water system towards road building. As Kamal reports, after independence from colonial rule, the government initiated a 'Five-Year Road Plan' with 5,000 miles of road as a target, and by 1951, 2,000 miles of road had already been added to the 600 miles in existence. Since then, the maintenance of the irrigation system and waterways as a navigable network has ceased to be a major priority. Some effort has been put into offering technical solutions, although Flood Control Projects appear to be creating more problems than they are solving. The initiative has shifted from water to road and from community to government, and community knowledge has been replaced by elitist technocratic institutions[11]. Nowadays the shift from water-based to road-based urbanism is still emphasised in the Khulna Master Plan. The crucial roles of the construction of the Rupsha Bridge, the Export Processing Zone near Mongla Port, and the new airport in between Khulna and Bagherat in boosting the regional and

[9] Kamal, A., "Living with Water: Bangladesh since Ancient Times," in "A History of Water. Water control and river biographies," edited by T. Tvedt, E. Jakobsson, London, Tauris&Co.Ltd, Vol.I, 2006, pp. 194-213.
[10] Khan, M.S., "Multiple Use of Ponds," Dhaka, University Limited Press, 1999, pp. 165-66.
[11] Kamal, A., Ibidem, p. 206-207.

national GDPs is clearly stated [12]. Huge investments have been put into the construction of the new 150km highway connecting Mongla, Bangladesh's second harbour city (60km south of Khulna), with Dhaka. This highway is roughly half the distance between Chittagong (the primary harbour city), and Dhaka. Although this is an attempt by Mongla Port to compete with Chittagong Port, the draft in Mongla Port is not deep enough to harbour large container ships due to the considerable amount of sediment flowing downstream annually, with even the idea of dredging proving implausible. Despite this flaw, the national road has already been built and the bridge over the Padma River is the only missing link on the way to Dhaka. The construction of the city by-pass crossing the Rupsha River and connecting the city with the new highway represents another large scale intervention. At a length of one and half kilometres, the Rupsha Bridge's monumental size is very distinct, and introduces a large scale object into the flat landscape. All the plots along the bypass and the Rupsha Bridge have already been sold for future development. The wide bridge figure contrasts with the congested Rupsha Ghat, which is one of the busiest ferry crossings of the seventeen along the urban river edge. Investment and design are required in these congested and lively points, yet the master plan of the city suggests the construction of five new bridges without the mention of possible interventions in these busy urban hotspots, where much of the local formal and informal economy takes place.

In 2001, another large investment in infrastructure was the construction of the Export Processing Zone less than a kilometre from the virtually inactive Mongla Port. Despite the evident lack of basic infrastructure in the rural and urban areas, 124 plots have been equipped in the zone, yet after approximately seven years only 27 plots have been occupied. As a product of a policy introduced in the 1980's to attract foreign investment, this serviced duty-free area never took off, due primarily to a lack of gas and transport connections. The 'quiet industrial zone'[13] has only 11 factories running and provides a mere 250 jobs, despite the 22,000 hoped for. The strategic location of the EP Zone to solve regional employment problems is questionable. In addition, to further encourage foreign investment, another airport has been planned between Khulna and Mongla, along the new highway. Instead of enlarging the already existing airport of Jessore, this international cargo airport, which is yet to be completed, has been located to service Khulna, Mongla Port and the EPZ. Whilst the infrastructure in the EP-Zone is under-utilised, there is a paradoxical lack of proper, basic infrastructure in the urban and rural areas. In Khulna, waterways or water bodies are used as sewers and drainage, and the sewerage system needs suitable upgrading. Coexisting with drainage, the sewerage is canalised and covered by concrete slabs on road shoulders. Often these coverings have holes or are even totally absent, transforming it to an open sewer. Between the road and the pathways, solid waste intermingles in the channels with the liquid waste. In denser urban areas as well as in slums, the sewerage system is an above-ground concrete channel designed to reduce the chances of flood-season overflows and acting as preventive measure against water-borne diseases.

Despite its importance during the colonial period, the railway is currently underutilised. Completed in 1885, the jute iron route, between Kolkata and Khulna, represented an important spine for the industrial development and growth of the city of Khulna. Connecting Khulna with Jessore, towards the north-west, and Khulna with Bagherat, towards the south-east, the railway is interrupted by the Bhairab River. Underutilised and largely abandoned after the city's industrial decline, the tracks have now been re-invented as open collective spaces for the slums that mushroom on the leftover sites along it, barely disturbed by the passage of occasional trains. To revitalise the railway, the master plan proposes to add a line from Khulna to Mongla Port, although it also highlights the impossibility of furnishing the Rupsha Bridge with a railway track. The master plan envisages this large urban void, owned by the railway company, as the future CBD of Khulna.

Little attention can be found in the master plan to the water network. Besides recognising the importance of the Bhairab-Rupsha as waterways and pointing out the need of regular dredging, water management has been left to a number of agencies. The water network is not taken into serious consideration as an economic structure and a possible economic driver in the region, neither as mobility network nor as an irrigation system. In so doing, the master plan seems to neglect the fact that this region was, and still is, primarily an agricultural and water based-society. The importance of the irrigation system and the navigability of the riverine system are crucial tools in sustaining not only the rural but the urban industrial economies as well. Passing from water to road-based urbanism, this region is not only neglecting part of its culture but also losing opportunities. There is also a tendency towards over-determined and non-functional

[12] Khulna Development Authority, "Khulna Master Plan,". Aqua-Sheltech Consortium, Vol.I., 2002, p. 19.
[13] Parvez, S. [2008]. The Quiet Industrial Zone. *The Daily Star*. www.thedailystar.net

zoning, rather than having an in-depth understanding of the nature of the region. The construction of the highway is a clear metaphor of the priority put into the urban area. The effort is concentrated on rapid connectivity between major urban points, whilst passing indifferently through the rural areas. The question therefore emerges as to how this large infrastructure can also offer benefits to the rural areas.

4 R-URBAN DISPERSION

On the dispersion of rural settlements of the JKM Region, Jessore, Khulna and Mongla are exceptional in terms of processing and urban density. At first glance, one could questions whether Khulna really is a city. From above, the urban fabric appears to have as many buildings as palms trees, reminding one of the fact that Khulna was originally a forest. From rural to urban, the tissue increases in density, scale and programme. While the presence of rice paddies decreases, it maintains a high level of openness. The porosity of the urban tissues, made up of traditional court houses, modern buildings, ponds, urban agriculture and post-industrial voids, defines the hybrid character of Khulna as super-village, where urbanity and rurality coexist. Developing from an agricultural trading village to more industrial urbanised city, Khulna is today the third largest city in Bangladesh. In spite of the recent construction of Khulna University representing one step towards becoming a service industry, in its post-industrial phase, the city no longer has a clear identity and lacks certainty regarding its future.

Moving from urban to rural, the landscape changes in subtle ways, the wide and open paddy fields are predominant figures, intermingling with rural settlements. Deeply linked to agricultural practices, the dispersed rural settlements occupy each strip of safe highland in available proximity to the agricultural fields, upon which they depend. During the rainy season, the homesteads become 'islands' with surface communication by boat. Homesteads are clustered in *paras,* and several *paras* form a village (*mauza*). The homestead is not only a social unit, but also a unit of production. The deltaic pavilion is covered by a large canopy roof (*chhad*), protecting it from the strong sun and torrential rain, enclosed by wind permeable walls and equipped with a semi-enclosed veranda, in continuity between inside and outside. In this way, the native architecture not only responds to human necessities, but also to climate and environmental conditions. 'It is also the basis of a paradigm – the deltaic pavilion, a machine for dwelling in the delta. While it signifies "man's first confrontation with the problem of architecture" in a particular place, its paradigmatic development may be seen as a thousand year old reflection on ecology, sociology and mythology'[14]. Along a similar logic, rural settlement morphology directly depends on the natural topography and hydrographic conditions. Following the natural levee, the settlements can be linear, scattered or nucleated. From the smallest unit to the largest organised settlement, each entity is deeply embedded in the 'indubitable delta, ever returning with its wind, water and clay', depending upon it and actively interacting with it. 'An understanding of deltaic urbanism lies, not in the dense labyrinthine fabric of cities like Jaipur or Lahore, but in city-forms east of the Bengal delta, the "rice-culture" matrix, where the distinction between urban and rural morphology has not been so oppositional, and where buildings took their place in the natural milieu with minimal turmoil'[15]. Scattered in the agricultural fabric of paddy fields and densely clustered in settlements on safe highland (787 people per sq km), this water-based society shapes a form of deltaic r-urbanity[16].

Currently, this agricultural and water-based society is experiencing a difficult period, due to the constantly increasing population size as well as food shortages. Moreover, there is a shift from small to large farms and from rice production to the more lucrative shrimp farming. Shrimp farming however, contributes to an increased level of salinity of the water, which is already quite high in the region. This directly diminishes the productivity of the rice paddies. Therefore, even the small farmer is forced to change to shrimp in order to survive, contributing once again to the rise of salinity, and completing the vicious circle. Due to the fact that the agriculture-based economy is no longer able to satisfy the nutritional needs, nor to provide enough job opportunities, the phenomenon of rural-urban migration becomes even more prominent. Obviously, this is not the only reason for this migration, as these areas are mainly under-serviced in terms of sewerage, water provision and electricity, and in terms of social infrastructure. People therefore migrate towards urban areas in the hope of a better future. Mainly of those migrating, located along the underutilised railway track and the

[14] Ashraf, K.K., Ibidem, p. 22.
[15] Ashraf, K.K., Ibidem, p. 23.
[16] Khulna Development Authority, Ibidem, p. 23.

industrial areas. Khulna counts 520 slums, about 20% of its population, of which 70% migrated from the surrounding rural areas. In these areas the city's density rises from 20,346 to 132,988 people per sq km[17]. By occupying the leftover spaces, these overcrowded slums not only have frequent drainage problems, but also are mostly under severe flood risk as they lie on lower available land in the city. Under normal flooding conditions, 40% of the slums are flooded, and this situation becomes increasingly worse with a rise in the number of bad floods.

Coexisting in different gradients, these two parallel identities of rurality and urbanity are both in a state of uncertainty. Agriculture-based rural areas and industrial-based urban areas are separately no longer able to boost and service the new socio-economic development. Focusing only on equipping the city will support the continuation of rural-urban migration and increase urban congestion. This means avoiding the opportunity of solving the problem at its source. Structuring the rural areas and the urban context, in a synergetic cooperation, could open new opportunities for the development of the territory. Beyond the rigid notions of urbanity or rurality, taking further the already present r-urbanity could represent a plausible option to investigate.

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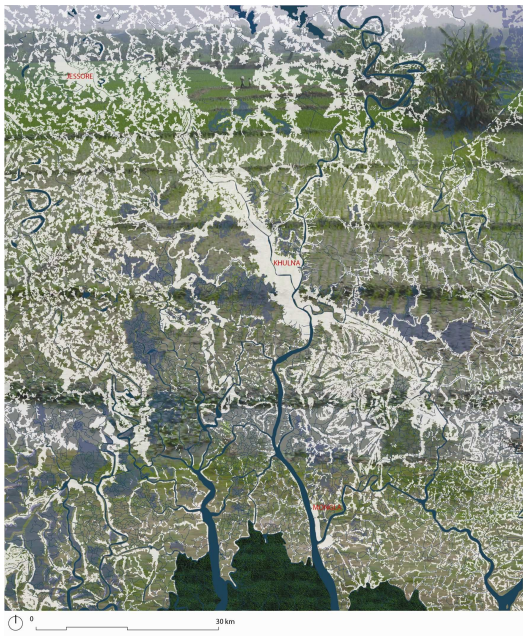
Strategically reinforcing the r-urban dispersion, by counterbalancing rural-urban migration and by rebalancing the natural and human processes, is a plausible option to improve the current socio-economic and spatial situation in the JKM Region. What if topography re-moulds the territory to support a new form of r-urbanity? Recognising its importance in the deltaic landscape, topography could be used as the primary common tool of intervention. Re-moulding the topographic conditions, providing safer/higher spaces equipped with civic amenities, could transform the territory as a support to existing and future urbanisation. Introducing new rules to regulate the relation between water and urbanisation, and new spatial tools, namely water purification, productive afforestation, sediment reclamation and social infrastructure, could rebalance the coexistence of natural and human processes. In so doing, a new form of r-urbanity emerges, combining the rural-agricultural and urban-industrial logic into a mixed-use program.

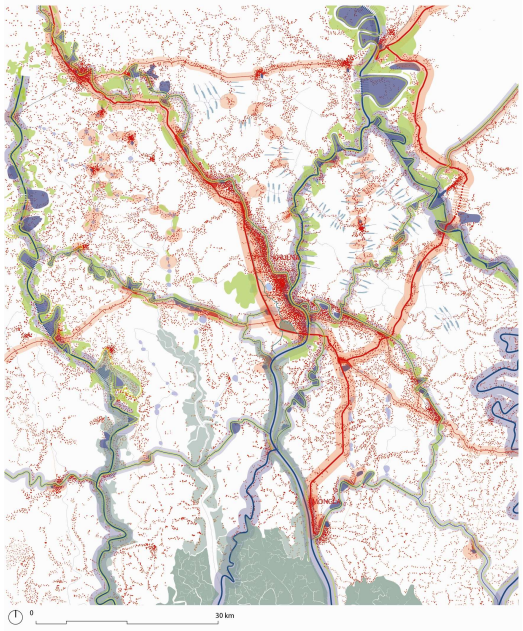
The re-introduction of the mechanism of 'cut and fill' is the first tool applied, for maintaining the balance between permeable and impermeable surfaces, and offering safe/high land. Taking advantages of the large amount of silt coming downstream causing river siltation, the soil could be used to reach a safe ground level. Along the river banks, the brick factories depend directly on the flow of sediment, which recharges the clay field. Often their locations are strategically chosen in the inner part of a meander, where the silt naturally deposits. By re-interpreting this logic on a large scale, the quantity of sediment reclaimed could amplify, and not only be used for construction materials such as brick, but also as a basic material to re-mould the topography. Increasing the land height could finally provide safer/higher land for different uses. In addition, the traditional overflow irrigation system, studied by Willcocks, could be recovered, reinserting smaller canals perpendicularly disposed along the river and permitting the water to flood the fields and deposit precious lime. This water system connected to water reservoirs, could simultaneously provide fish farming, water storage and regularly dredged silt catchments. Reclaiming sediment is a socio-economic driver, providing raw matter for brick production, improving agriculture production and increasing the available safe highland.

Despite the complicated water system previously described, water purification is still absent. Moreover, waterways and water bodies currently replace a sewerage system. Therefore, the introduction of water purification systems becomes crucial. Constructed wetlands and aerated lagoon water treatment could be inserted, not only to purify water, but also to guide future densification and provide public spaces. In this sense, the aerated lagoon project[18] along the Den Canal in Ho Chi Minh represents an interesting sample of a multipurpose system. It not only cleans the highly polluted water of the Den Canal but also partially compensates the dense urbanised city with a large urban void and provides an open public space along its edges. Located in between settlements and rice paddies, the water purification system defines a new edge to the settlement, changing the urban morphology. In order to protect the water purification system from flooding, the borders need to be higher, defining a border of higher/safer land. The purified wastewater could

[17] Centre for Urban Studies, Ibidem, p. 22.
[18] Legrand, B., Shannon, K., "Aerated Lagoon Park in Ho Chi Minh," in "Topos", No.59 (2007).

be used for agricultural purposes, the dry sludge used as natural fertiliser, and the last maturation pond for farming fish (tilapia). The maintenance of the water purification system does not require much effort, and represents potential job opportunities. The implementation of the water system is multifunctional, not only improving ecological and health conditions, but also increasing productivity and, in the public realm, defining new types of public/open spaces.





Figures 1 and 2 Interpretative map and one possible vision of the JKM Region[19]

In order to reinforce the rural areas, the implementation of social infrastructure is crucial. Lying on safer/higher ground, social amenities could guide the future urbanisation (and de-urbanisation) and therefore define the urban morphology. These social attractors will be strategically located along waterways and at the encroachment of settlements with important roads, in order to service the surroundings and offer a better accessibility by boat or by vehicle. Together with water purification and productive afforestation, these social amenities will have an impact on the public realm and public open spaces. On safer/higher land these places will be crucial during the rainy season, providing public areas free of flood risk. This social investment could play a key role in boosting the territory socio-economically. In addition, if these amenities can be combined with a new mixed-use program tissue, they could trigger interesting forms of r-urbanisation.

Partially re-balancing the Sundarbans exploitation, a productive afforestation program, implemented at a territorial scale, could provide several benefits. Firstly, enlarging the existing mangrove forest towards the north could improve its protective function during cyclones and partially balance the high salinity caused by shrimp farming. In addition, a rotational plantation program of *Gewa* could be linked to the industrial production cycle of the newspaper industry. Secondly, the introduction of different plants along the river shores could reduce the river erosion and increase the navigability of many rivers. Where access to a river is required, erosion could be prevented by planting bushes of *Vetiver*, which can be cut short, and have a strong root system to hold the soil. Moreover, plantations such as banana and coconuts will increase regional food productivity and provide construction materials. Therefore, the introduction of a specific and highly differentiated afforestation program could not only increase the biodiversity and re-establish the lost ecology, but also become an economic driver and food provider. In addition, the introduction of woods will directly affect the urban morphology, guiding the future urbanisation [and de-urbanisation], and defining new open shaded spaces.

[19] This possible vision has been developed by the KU Leuven Khulna Landscape Urbanism Studio guided by Prof. K. Shannon (Belgium, 2008).

The implementation of these spatial tools in strategically located areas could re-establish the inherent ecology and trigger new forms of r-urbanisation. Based on a flexible topographic vocabulary, these punctual interventions could lead to different scenarios, guiding future urbanisation and de-urbanisation.

6 REFLECTING ON UNCERTAINTY AND LANDSCAPE

Lack of potable water, natural disasters, food shortage, rural-urban migration and the consequent mushrooming of slums, are affecting Bangladesh and the JKM region in particular. Affected by these relevant issues and in its post-industrial phase, this region is in a deep state of 'uncertainty'. Nevertheless, this situation represents an opportunity to re-think the possible future for this region. In this way, the formulated hypothesis, of strategically reinforcing r-urban dispersion, by counterbalancing the rural to urban migration and by rebalancing the natural and human processes is taken on.

'The origins of architecture do not reside in the primitive hut, but rather in a primordial marking of the ground in order to delineate a human world against the unformed, chaotic indifference of the cosmos; in short, in the act of culture in the void of nature'[20]. The 'marking of the ground' as Kenneth Frampton means it, is deeply ingrained in the deltaic culture, dealing with the constant topographic change of pani and mati, and also in the practice of re-moulding the fertile floodplain into a productive landscape. Agriculture, as an act of transforming the territory, has represented a way of coexisting with water for centuries. Moulding the soil to create safe/higher ground and store water has proven essential to survival in these areas. It is clearly evident how crucial the 'design of the soil' is. The notion of '*progetto urbanistico'* as mainly '*progetto di suolo'*[21] formulated by Bernardo Secchi, finds a deeper significance and meaning in this floodplain.

Determined by necessities and context, the coexistence of architecture and nature generated a form of r-urbanity based on cyclical agricultural practices. In this context, [water-based] and densely populated r-urbanity is not adequately taken into account, and the opportunities it could open are underestimated. In contrast, historically the research into hybrid conditions, or intermingling rural and urban conditions, has investigated new forms of r-urbanity. For instance, the utopian vision of Broadacre city, proposed by Frank Lloyd Wright which explored possible opportunities of a decentralised system that amalgamated the modern elements of urbanity [industry, schools, etc] with an open productive rural-scape. The reflections made by Wright on decentralised systems of r-urbanisation, combining forms of [rural] agricultural activities with [urban] servicing and processing activities, offer a different starting point to reflect on the analysed area, and moreover, his accent on topography and landscape. 'Broadacre would be so actually built in sympathy with omnipresent nature that deep feeling for the beauty of terrain would be fundamental in the new city building: it would seek beauty of landscape not so much to build *upon* – as to build *with*'[22].

Responding to natural and time-based logic, r-urbanity, present in the JKM region, could be associated with the notion of 'weak and diffuse' urbanisation introduced by Andrea Branzi. In the utopian project of Agronica, Branzi investigates the potential of this notion envisioning an '*innovative mediation'*, beyond the old definitions of city and countryside.

Observing Jakarta's periphery, in 1987 Terry McGee introduced the term *desakota* [*desa* for village and *kota* for town or city] to describe the particular urban condition of its periphery. McGee noticed how dense urbanisation started from an already densely populated settlement pattern directly depending on agriculture. This phenomenon of agriculture-based compact settlements quite common in Southeast and South Asia, has been categorised by McGee in different types of *desakota* regions[23]. Beside the fact that the JKM region could be classified as a *desakota* region, it is relevant to notice the hybrid conditions of rural/urban and productive/consumptive which lead to a different form of urbanization. As Kelly Shannon points out: 'Recognition and abstraction of the idea of synergy between rural and urban, the consumptive and productive landscapes can become a guiding principle for future urbanisation of secondary cities'[24].

[20] Kenneth Frampton, quote found in Shannon, K., "Landscape Urbanism, Rhetoric and Realities. Addressing Landscape Urbanism. Three Cities in Vietnam," KU Leuven Doctorate, 2004, p. 115.
[21] Secchi, B., "Progetto di suolo," in "*Casabella*," No.520 (1986), pp.16-17.
[22] Wright, F. L. [1958]. The Living City. New York: Horizon Press. p. 112.
[23] Shannon, K., "Landscape Urbanism, Rhetoric and Realities. Addressing Landscape Urbanism. Three Cities in Vietnam," KU Leuven Doctorate, 2004, pp.92-93.
[24] Shannon, K., Ibidem, p. 94.

Figure 3 Prototype of r-urbanity

The distinction between rural and urban introduced into this context during the industrial period [and clearly questionable in today's conditions], is in net contrast with the dense dispersion figure, and moreover, it partially denies the hybrid condition and precludes new opportunities. Taking advantages of the state of 'uncertainty' and reflecting on the above ideas, the proposed suggestion involved widening the view and rethinking this territory as a system, which takes advantages of its micro-local logics and economies. Flexible rules and medium size, serviced densifications could re-structure this continuous productive inhabited territory, working in synergy with more urbanised areas. In doing so, this phenomenon of rural-urban migration could be partially counterbalanced. Meanwhile, with the new densifications, a new way of inhabiting the territory could be explored in the attempt to re-balance the natural and human processes. In awareness of the fact that rational fixed planning is no longer applicable, not only in the JKM region, but elsewhere, design research should question its role in such a context. Here, the topographic vocabulary is also an attempt at 'unpredictable planning', believing that only a flexible open strategy made of design rules could offer a way forward.

The infrastructural role of landscape has been partially lost, in a context where it seems more crucial than others. If 'everything is infrastructure'[25], there should be more emphasis, especially in this context, on remembering how landscape plays a crucial infrastructural role, as much as large 'concrete' infrastructure, in supporting the territory. The combination of different devices could open up new opportunities. The underestimated water system of this region represents one of its major opportunities. The water system could be used not only as a productive entity but also as mobility and purification infrastructure. Moreover, inserting a decentralised network of water purification systems could present many advantages in terms of cost and in the flexibility of enlarging and shrinking over time[26]. The traditional sewerage system is costly, mono-functional and inflexible. In contrast, the use of aerated lagoons in this context could improve health conditions, provide water and natural fertilizer for agriculture, and increase productivity in fish farming. The insertion of water purification systems could also reduce some of the water resource pressure on groundwater withdrawn for agricultural purposes, thus rebalancing the ecological relation between settlements and nature. In addition, re-establishing the ecology of this region through a plantation program could contribute to re-

[25] Statement of B. Secchi. Conversation (Delft, 25.04.2008).
[26] A. Stockman, Water Debate, KU Leuven (08.04.2008).

asserting the waterways as mobility infrastructure supporting the local agricultural economy. In conclusion, offering a shift in perspective, this paper is proposing a different way of looking at the territory. Underlining the intrinsic logic and possible opportunities of the territory, it is an attempt to contribute to, and incentivise future discussions and further research. Recognising the intense water system and the current state of uncertainty characterising this region are two challenging opportunities which could become interesting starting points for envisioning new forms of r-urbanity.

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