

INCLUSIVE FRAMEWORK INCORPORATING ECOLOGICAL ASPECTS FOR THE URBAN RIVERFRONT AND ITS INTERFACE WITH THE URBAN FABRIC-CASE OF VISHWAMITRI, VADODARA

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Abstract: Rivers have been an important part of city formation as they affected the morphology and land dynamics of the city. Considering the rapid urbanization, cities have started growing tremendously and reclaimed the edges of the ecological features with the unplanned or planned infrastructure in any cases. The city governments have been looking to this problem in many parts as the riverfront development being one. The riverfront being treated as the edge beautification has become the recent trend in the urban design realm. The understanding of the riverfront as an edge has led to many solutions that do not relate to what city they are and to the context they serve. The city is a complex phenomenon and to relate the riverfront to a larger development network to make sense out of the project and benefit the city for its development has been practiced in large successful waterfronts. Can there be an Ecological balance between a river and its context? Can the larger visions collaborate with the planning and design to help us to create a workable river management strategy? This research area shall focus on stitching the gap between different models to do a Place making exercise on the water edge for the city to generate public place. To formulate a comprehensive framework that incorporates Ecology and Urban forces to develop the interface between riverfront and adjacent built form. It aims to integrate the approaches for a systemic approach for the sensitive riverfront design incorporating suggestions at various levels of Development Plan, Local Area Plan or Area Based Development Plan and the Waterfront Initiative.

Keywords: Beautification, Blue Infrastructure, Development Plan, Ecology Place making Urban River.

1. INTRODUCTION

Waterfront has become important debate as it has re-defined the way people perceive water bodies. It has made people access the ecology and create a different picture of the ecological system. Relph in his book explains that waterfront have become a stage of experiences and expressions that the city has to offer for the people living in it and visitors. It becomes an amalgamation of various incentives that the waterfront models in recent trends plug in and make it an active recreational and public space for the city. Further, that makes it an important element of Image making in lieu of its scale, physical location in terms of dividing the city and by the fact that these elements have water in it. The question here lies as to what extent these intentions relate to people of that city and how far the initiatives support the ecological strength of the water body. Does the waterfront and water co-exist? What do designers perceive as waterfront? Is it only the edge or the interface between the water and the city that interacts with it? All the rivers around the world are facing serious consequences of the urban development as the development has eaten up the space for the rivers and tamed it as per the development models and visions of the designers and planners. There is an equal momentum about River Revival and Rejuvenation for all rivers to protect them and be of use to the city that it passes through [1].

Rivers have become sites for disposing urban waste, industrial waste, water pollution, threat to species and ecology around it. With the new meaning of riverfront being only the edge and the front that faces the river, the connections with water and city have changed its meanings and it has resulted into rivers being the trade off in the process of development. Lynch's (Lynch, Image of the City 1960) and (Lynch, Theory of Good City Form n.d.) deepens the understanding of the "front" and questions whether the edges should be manmade, designed, natural, public open space left for people's perception or everything of the above [2]. But the challenge with dealing with river is there are multiple stakeholders and at various scales of intervention. There needs to be holistic approach

to tie these things together and put a systemic approach to it and integrate planning and design

1.1. Framing Waterfront and its context

There have been various ways in which waterfront is defined but as US Federal Coastal Zone Management Act of 1972 suggests it to be heavily inhabited with large amount of diverse activities which majorly focuses on what kind of place waterfront should be and not really defining the extent or the boundaries of waterfront. Moreover, it points out to be “developed” leaving no scope for the understanding of its natural state of intervention. Understanding water systems in a larger envelope, it gives opportunities to the context to utilize it as a resource and not commodity. Brutomesso definition stitches waterfront to a larger domain of interaction between the water edge and the urban built form and allows the flexibility of the brief for the understanding of the land abutting the water body, built form around it and the water body itself [3], [4].

- *Relation between city and water*

‘The New Waterfront, a worldwide urban success story’ suggest several typologies which are as follows:

- *Commercial Redevelopment*

Tourist attraction providing various restaurants, hotels, shops, open markets along the shoreline

- *Historical Redevelopment*

Focusing on Pedestrian, restoration, reinvention, and modernization of the existing infrastructure Cultural, Educational and Environmental Redevelopment Museums, theaters, open concert spaces, aquariums, ecologic and technological parks are created targeting both specific and general audiences.

Understanding the riverfront after Globalization, the perception and association of people changed with River as commodity and image making. Historically waterfronts globally have undergone a tremendous stage of evolution and is currently under the stage of Renewal and Revival strategies all around the globe. The global image making is so imposed on the waterfront that cities have started competing in reference to their waterfronts. The city’s identity is portrayed in a very local level and not reflected in the larger master plan. Cities based on their historical evidence developed waterfronts on various themes like historical, commercial, and cultural. The waterfronts became a stage of expressions that cities could showcase. Environmentally sensitive waterfronts have become the trend for new waterfront development, but the understanding seems devoid of the systemic level and the relation of the waterfront with the water body itself. The redevelopment strategies of the waterfront focused on showing the local image of the city for tourism purposes. Waterfronts became a canvas for the collage that the city wanted to express and portray.

2. LITERATURE REVIEW

Prayitno, Budi in a study illustrated that the hyper-urbanization phenomena have resulted in significant improvements in urban living quality, but it has also resulted in an equal number of issues. Density concerns, the presence of slums, floods, socioeconomic inequality, and metropolitan architectural identity are all examples of environmental difficulties. Authors found that due to significant land-based infrastructure development, Banjarmasin, the "City of a Thousand Rivers," is now facing a transformation in its urban architectural appearance from a river-based city to a land-based city. Due to a substantial paradigm change, the environmental and cultural quality of lagoon village (kampong) inhabitants, the primary component of Solubility River front city, deteriorated. Kuin is undergoing urban renovation, a riverfront residential area/riverside tourism attraction that is now witnessing a decline of soil stewardship and place identity. Unfortunately, owing to a lack of rules based on riverbank place identity, policy approaches to spatial regeneration have been applied that are based on generic formal standards; recommendations that do not take the unstructured character of kampong river-side communities into account. Authors investigated the characteristics of riverside settlements using architectural image observation, space syntax approach for determining settlement connection genotype, interoperability, user experience and interlink territory integration, and questionnaire and interview methods to assess residents' and municipal authorities' perceptions.

K. Dovey and F. Symons in their study illustrated that Five types of compositions have been discovered as a

consequence of this study: Pilling, stretching, floating, embracing, and climbing with components such as waterfront lanes, jukung (traditional boat), lanting (floating dwellings), and floating traditional markets that serve as the frame to the arrangement. The identification procedure is carried out by monitoring the appropriation of space and the view of space-users on how to regard the sustainability component as a way of determining a degree of adjustment. Authors found that inhabitants and tourists in self-organized and personalized kampongs are aware of the river ecosystem, the assets of local water marketplaces, and the local lounge area. Municipal governments, on the other hand, paid greater attention to formalized normative and regulatory concerns. This study serves as the foundation for proposals for the consolidation of kampung riverfront settlement design, which is accomplished via guided co - creation workshops. The study's findings are being developed as a model for urban riverside composition building, intertidal space territories, and urban river settlement identity, and are anticipated to contribute to the field of urbanization and territoriality research.

Durán Vian et al. in their study illustrated that Cities all throughout the globe have been rediscovering their rivers since the 1970s. The recreational usage of urban streams is growing in popularity, and open participation to waterfronts is improving. As a result, a multitude of public open areas along the riverside have been built, each with its own unique manner of engaging with the river ecology. In this study, we developed a categorization system for riverside parks and walking based on two standards: the open space's location inside the riparian zone and the open space's access to the water. Seven European urban rivers were researched to see whether the categorization structure was applicable. The categorization procedure showed that health recreational riverfronts may be divided into three distinct categories: floodplain, upland, and elevated places. Fluvial subclass differs from riparian subclass inside floodplain regions in that the former offers easier access to water. The case study validates the categorization system's validity and shows how it may be used to characterize open space classifications. Despite the fact that their spatial qualities allow for practically limitless creation and application, we discovered that each class has its own set of patterns. The approach established and its application allows for the estimation of the number of public areas in the urban river corridor, provides an organizational context for explaining river-city recreational interactions, and aids in the evaluation of the riverbanks' ecological status.

Research Questions:

- Can there be an Ecological balance between a river and its context?
- Can the ecology and the built form weave together to create a better public space?
- Can the larger visions collaborate with the planning and design to help us to create workable river management strategy?

3. METHODOLOGY

3.1. Design:

To formulate comprehensive framework that incorporates Ecology and Urban forces to develop the interface between riverfront and adjacent built form. It aims to integrate the approaches for a systemic approach for the sensitive riverfront design incorporating suggestions at various levels of Development Plan, Local Area Plan or Area Based Development Plan and the Waterfront Initiative

3.2. Sample and Instruments:

The inquiry will question the land use around the water edge and work for the justifiable framework responding to the context and plug in those activities and built form that would enhance the ecological identity of the river. The framework will evolve from the aspects of sustainability and reducing the ecological footprint of the built form around the water edge and formulate a comprehensive palate for the fundamentals of the riverfront development which integrates it to three levels namely

- Development Plan
- Local area plan

- Waterfront Initiative.

3.3. *Data Collection:*

The research methodology for this study focuses on building up the framework depending upon literature studies and global scenario of the waterfront and the current trends of implementation of master plans and comparing them to the physical practice of the riverfront design and trying to articulate the gap between the two processes. The framework formulates a strategy to help formulate and sieve the fundamentals of the urban design principles required for designing river fronts and which are non-negotiable.

3.3.1. *Indian relations with water:*

3.3.1.1. *Territoriality and Ephemeral character:*

- River edge being the connector of built form and Ecology has lot of urban forces as the character of edge can either connect the communities to the water body or act as a separator.
- Seasonal character of the river makes it very important for the edge to respond to the temporality and do not provide a dominant character and hold the river.
- The transformative edge of Varanasi is an important example of urban fabric responding to contextual edges and the painted canvas represents the choice of the function dominated by people.
- The built form negotiates with the edge as per the required brief at the destination and not a superficial monotonous master plan that paints a broad-brush strategy for the edge

3.4. *Data Analysis:*

Transformative edge of the Varanasi Ghat bringing the informal activities to edge. Built fabric helps people to access the edge and water body without following a certain choreographed program. The idea was to design the non-negotiables and brief of the activities around the river and not really designing the parallel connections with water. Human relations with water changed completely when river became a Destination and not something that they access daily in their course of life. The idea of designing the connections that are parallel to the river and not perpendicular also made the river more inaccessible by the public.

3.4.1. *Spatial meanings of the riverfront:*

3.4.1.1. *Place and Identity:*

The idea of creating one master plan having similar character and design language for the entire stretch of the riverfront makes it so monotonous that people fail to associate themselves with it. The diversity of each place abutting the river and its identity is not reflected in the visionary master plans proposed in the country. Rivers are a part of identity of the city but when the city and river identity is not the key element of the design process, the idea remains to overlap a third image on the context. Global image Making and competition between cities with their riverfronts have left the river ecology as a trade off as the place around the river is designed as a stage for image making.

3.4.1.2. *Cognition and Waterfront:*

- Considering five important elements of Lynch (Image of the city, 1960) waterfront can have a great influence and potential to become a District, An Edge, A node and Landmark.
- The urban waterfront can be considered as a point of separation or connector to the wilderness of nature.
- It can be treated as a series of complementary relations between the city, its inhabitants and water.

The contemporary need to reclaim the urban frontier (Bruttomesso 2001) affects greatly the psych spatial effect it has on the users when they experience it. When trying to reestablish the connections between the urban fabric and water all physical characteristics are scrutinized. How do the *regional, urban, and architectural* scales interrelate and work as a system?

3.4.1.3. *Site to region:*

- Relevant urban, agricultural, and natural characteristics of the project site.

- cultural and economic assets
- Bioregional system that forms the general attributes of the site

3.4.1.4. Site to site:

- relationship between the site and its neighboring site, specifically in terms of context, scale, view corridors, materials, geometric relationships, neighborhood characteristics
- usable relationships derived from the site and environmental analysis
- vegetation types and the soil and water retention characteristics
- parts of the site's microclimate related to seasonal and diurnal changes are impacted by adjacent land uses

Site to Architecture - Synergistic relationships between the site's climate and those of human needs and comfort Formulating a framework which is comprehensive of the fundamentals of riverfront development as three scales of Regional, site and riverfront.

3.4.1.5. Formulation of the Framework:

The framework is a tool for designer to understand the urban development as holistic approach and respond to river as an important element of it and not design the individual parts in isolation. The framework is a set of fundamental parameters that are prescriptive for the larger urban development with Ecology as an important concern. The parameters considered for the framework are based on the analysis between the theoretical understanding and the parameters of design in the case study.

- Environmental Concerns
- Connectivity
- Identity of City
- Culture and Heritage
- Social Importance
- Economic Importance (infrastructure)

Streets: The streets should be designed in terms of last mile connectivity and pedestrian accessibility. The hierarchy of the streets should be in terms of people accessing the streets and neighborhoods around the main streets. Designated green streets should be provided for pedestrian activities. Seamless access to the riverfront should be provided from all the adjacent neighborhoods. Figure 1 shows the Formulation of Framework at Generic Level.

Bridging the gap between Economy and Ecology



Figure 1: Illustrating the Formulation of Framework at Generic Level.

4. RESULTS AND DISCUSSION

4.1. Connectivity

Topography - The larger topographical conditions of the city in terms of the watershed connections needs to be collaborated with the physical connections of network and transit. The land available for the development must be in relation to the larger watershed relations of the aquifer and should not block the natural slope. The natural drains of the water body should not be blocked with the development near the ecological sites.

Regional Transit Connections – The existing transit networks should be combined with the new transit locations and destinations created with ecological feature as one of the transit destinations. The destinations should be a part of the shared transit loop with increased public accessibility and pedestrian networks. The last mile connectivity of the networks should be considered for planning of the transit loops. The connectivity and public accessibility of the transit loops should be in continuation for seamless transit experience. Developing a regional network that takes ecological feature in its loop with ecological feature as a destination. The development near the transit junctions needs to be transit oriented development.

Pedestrian networks should be interconnected with the idea of common public place with water visibility. The character of the public place should be in response to the ecology and natural flora, fauna around the place.

Green Network – The water bodies and the parks in the city should be connected with the transit networks and aquifer connections supporting the ground water recharge. The intermediate parks should to the larger public place – the riverfront. Seamless accessibility of the riverfront should be maintained from all the points. The open spaces should be publicly accessible and the riverfront should be accessible from all the spots around the edges.

Active Edges – The neighborhoods around the river edge should be made active with maximum public accessibility and pedestrian connections with the river. Green networks should be integrated with inter neighborhood transit plan maximizing the use of the transit network. Live, work and play concepts to be applied to the neighborhoods in the proximity of 500 meters of the river edge. Continuous promenade to support cycling, jogging should be promoted.

Destinations – Identifying the existing and new destinations with regional and local transit networks for better accessibility of people. The riverfront should be part of the regional and local transit network connections. Destinations should be points of interest for the locals.

4.2. Image of the City

Global Identity - The idea of identity of the place should be on a singular idea of economic or infrastructure identity but on ecology as resource with regenerative skyline emerging from the place. The global vision should be equal access to the public riverfront and to make the ecological identity of the riverfront. The character of the riverfront should be very local respecting local needs and respond to the place making theory.

Policy making – The policies for land reclamation on the riverfront site should respond to the ecological conditions of the site and the land use around the river should be restricted to residential or institutional. The land pooling should be in proportion to the existing grain sizes of the neighborhoods and integrate well with the existing site conditions and the proposal should not be alien to the site.

River as Image – Traditionally, Indian rivers have much more importance than the physical use and every river has a social, mythological, and cultural connect with the communities. The Image of the city should focus on enhancing the importance of the river rather than imposing a global Identity to the place.

Habitat / Flora / Fauna – Diverse species of animals and plants are found in and around the Indian Rivers which

should be preserved and respected from the ecological perspective. The development plan should integrate with the Waterfront plan to enhance the habitat of the species and revive the character of the river.

4.3. Culture and Heritage

- Heritage Precincts - Identifying the existing Heritage Precincts and enhancing its relations with river by developing a Heritage Trail, activating the regional and local associations of people with the monuments. Re-interpreting the heritage precincts to its larger regional connections with ecological meanings. Providing seamless access points to heritage precincts and ensuring safety of the people.
- Cultural Associations - Community participation in the activities on and near the active edges should be given more value in developing the transit connections. All heritage destinations near the river should relate to the public transport and pedestrian networks. Identifying processes and processions of the communities in the city actively using the river. Flea Markets, Community Spaces, Ghats, Maidan, Children Play Area, Public Places, Institutions should be a part of the river development plan enhancing the cultural identity of the place.
- Place making – the idea of common right of the people on the riverfront should be celebrated by making diverse and active places which are dynamic and robust in nature. The transformative program of the edge condition should vary in terms of place making and add value to the existing conditions.
- River Typology – the built form typology around the river should be regulated, with the assurance of permeable

Visible and physical connections to the river. The built grain module should be in accordance to the existing neighborhood grain size.

- Informality- Regenerative planning for the informality to generate its own character on the Edges of the riverfront rather than having one strong imposed character. The river promenade can be accessed by diver program around the edge reflecting the cultural Informality of the place.
- Institutional/Civic - The institutional places around the river edge proximity should Provide equitable access to the riverfront and enhance the relationship with river and Contribute to the public ness of the place by approaching theriver through Ghats and access roads

4.4. Social Associations

- Inclusive Planning - Identifying the social activators and linking them with appropriate land use policies. The use around the river should be regulated. The building height on the river edge should not become a wall obstructing the visible access of the river.
- Community Place - Making the place dynamic with the multipurpose use of the land designated for the social activities. Extending fabric of community with the larger transit and policy level decisions and providing them equal accessibility to river. Transitions In nature of public spaces to be provided.
- Religious Connects - Identifying the religious associations of the communities with the river and connecting them to the larger ecological values of preservation and conservation. Enhancing the value of the religious destinations around the river by integrating them with the concepts of place making and making it accessible to public.
- Temporal Spaces – Identifying the number of temporal and dynamic activities happening during certain time of the year along the river edge and enhancing them by giving them identity in the land Use Plan and connecting it to larger loops. The character of the place should be facilitating to the diverse needs of the use of the place.
- Parking – Calculated parking needs to be provided at least 500 meters away from the river edge for the visitors and user groups. Cycle and e- cars to be provided for easy accessibility to other transit loops

Pedestrian Networks - Increasing the links to the waterfront and its edge with pedestrian character. Universal access of the riverfront should be taken care of. The social associative routes of religious processions should be restored making people relate to the place to larger extent. Affordable Housing – Riverfront address to be provided in a socially just manner and social housing should be encouraged [5], [6].

4.5. Economic Infrastructure

Mixed Use Economy – Enforcing strict land use in the proximity of 1 kilometer radius of the river. Mixed use Economy should be promoted for vibrant and dynamic public spaces. The uses along the river edge must contribute to the public space production.

Identity of the place – River development plan should have multiple identities in terms of the destinations Rather than one singular identity. The identity must follow the sustainable tools and methods. Ecological identity of the water body must be given the priority.

Net Benefit – Adaptive reuse of the old industrial structures along the river, if not functioning to better civic Use. New land use and structures to be proposed on the riverfront sites to make it active. The riverfront road should not be physical separation between the two transitional spaces on the riverfront.

Water Transport - Exploring water as a transit medium, helping people to relate with the ground realities and support river cleanliness. Transit oriented development links to be integrated with the water as transport to support easy public movement.

Business District – Multiple business districts should be promoted activating multiple destinations. More Real Estate value to be given to the business district in terms of development rights and FSI and all the buildings must contribute to 15% of the ground space as public space. FSI in the 500 m of the river edge should not exceed 4. The buildings should not exceed their foundation or basement in 100 meter range of the river edge.

Net Zero Infrastructure – The buildings along the river edge should follow the principles of reducing waste and low carbon emissions subscribing to the standards of net zero infrastructure.

Urban form of the city revolves around the natural feature in Vadodara and it being a large public asset it is utmost required to make it available to public realm. The present condition avails the use of river for dumping the waste of the city and the city faces its back to it. Taking its meandering form into consideration and lack of public spaces in Vadodara gives credit to utilize the land around the water edge resulting into the need of making the adjacent neighborhood respond to the river. The meandering feature gives multiple avenue opportunities to open the city to the river and vice versa. The additional important element of concern for the city and the water body is the presence of crocodile habitat in the river making it a design challenge to merge those territorial boundaries and utilize the space for the city public realm. How design can bridge the gap between eco sensitive water edge and the built form around it. It probes in the inquiry whether design can bring the change in the meaning associated with the water body since ages in case of Vishwamitri. The design restricts the idea of development only along the waterfront but also weaves the local area around it to direct the development models and give revenue justification to the area benefitted by the high FSI zone. The project revolves around Eco sensitive experience around the water edge and how can urban design create meaning for the public experience for the available asset. Integrating the vision of eco- sensitive urban experience with the smart city agenda of the city is the larger identity of the project supporting the city's infrastructure. The abandoned water edge is the right of the city and the current footprint does not justify the development nor respond to the river. The built form around the river in many areas are in isolation and not in sync with the larger agenda of public vision [7], [8].

4.6. *Current Status of the River:*

It is very evident that Vishwamitri roots its origins to the city of Vadodara and cuts the city into two parts, meandering and giving the urban landscape a form that makes the city a unique location in terms of ecological biodiversity. The river is the rare abode for the crocodiles making the context a separate visual identity. Figure 2 discloses the demonstration on Vishwamitri River.

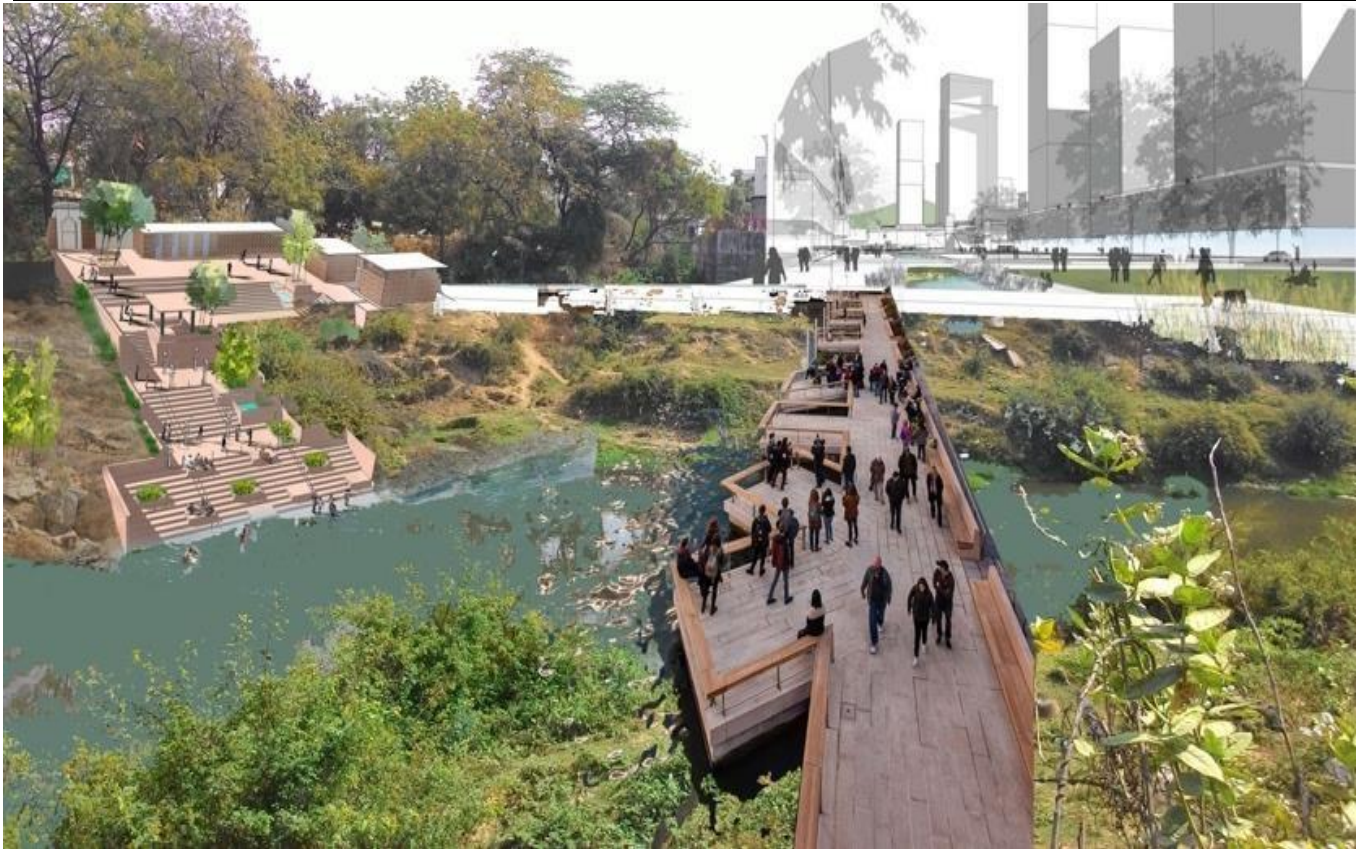


Figure 2: Demonstration on Vishwamitri River, Vadodara

5. CONCLUSION

River being a part of multiple state boundaries and cityedges in many cases becomes difficult to be tied with one design solutions and the fact that they need to be designed. The water elements in some instances need to be left in natural state by identifying the development sites along the stretch and developing the potential of the same. The framework in that case helps the designer to reinforce ecology as important elements to guide the development process and follow the parameters suitable to the city it is designed for. The dynamic nature of the framework helps to reintegrate the local character of the region to be stitched to the visionary development model. The idea of thinking global but acting regional stands true with the framework.

Though the framework is not a template of do and do not but a guiding list of parameters that are fundamental to the design of the public realm. The varied scales of the framework helps to focus on the vision of the city with multiple lenses and ideas of implementation at various levels. The multiple stakeholders play their part at every level and enrich the framework with their inputs without one overarching agenda that everyone follows. The framework also tries to put upper limit to the concerns and helps the design initiative being carried away in economist model. The conflicts identified can be solved with various programs and models which generate out of this framework. Various consultants need to be part of this framework execution dealing with individual parameters and design principles that benefit the parameters in the holistic manner.

The framework helps to form a list of parameters to be considered for a particular situation without compromising on the fundamental principles of Urban Design and Planning. The framework stitches with the context specific situations with the fundamentals in place to solve the issues of water sensitive planning at grassroots level. However, this framework concludes that rivers cannot be treated and designed in isolation by taming the river and sourcing the water from other river and being ignorant about the surface water runoff and the ground water. The re-routing of the river not only harms the ecology but also the ecosystem that thrives on it. With globalization and changing relations with river, framework and guidelines need to be framed with various levels of negotiation in consideration.

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