ARE FLOATING CITIES THE URBAN FUTURE?

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ABSTRACT

The vision of marine settlements evolved in the 19th century from the concept of living aboard a sailboat which is now known as sea steading. From thereon, the architecture community gave us a glimpse of innovative design experiments with strong statements which depict the agenda of revitalising the chaotic urban world. One of the most important and significantly urgent challenges for contemporary urbanisation is to develop their extent of sight beyond the political and social insights of the city to address changing morphological terrains of urbanization. The transformation of the world that the 19th century created is the framework for the global systems which are continued even today. The futuristic vision of the utopian architects in the 1950s gave a path to believe that urban settlements could be built in extreme geographical conditions like the polar regions, the deserts and on the sea. The floating cities are still not a reality, but the longstanding vision is gradually making its way to become the urban future in the hope to sort the contemporary urban issues starting from the scarcity of land at global level due to over population to the drastic climate change due to the exploitation of nature by humans. Floating cities clearly intend to become a crucial architectural element in the future urbanization. The theory behind the concept of future urbanization is intended to help explore the unexplored morphological terrains for urban restructuring around the world. In this paper floating cities will be analysed to understand as to how "self-sufficient floating cities" could combat contemporary urban issues and also influence future urbanisation.

Keywords: floating cites, urban future, urban environment, amphibious architecture.

1 INTRODUCTION

Could "self-sufficient floating cities" combat contemporary urban issues?

The city is the necessary instrument for the evolution of humankind [1]. But due to the rapid urbanisation the urban cities have been deteriorating mainly due to human activities which affects the environment and then eventually the humankind. The main urban issues faced are increasing population and rising sea levels due to drastic climate change which also has a major impact on the earth's ecosystem. 60% of the global urban population will be residing in the cities by 2030 [2]. This is going to be very stressful for the urban cities as they must battle with the population against extreme climate changes. 90% metropolitan cities are situated in the coastal regions which are vulnerable to the rising sea level caused by greenhouse gases leading to the sinking of the cities by 2100 [2]. Even if we reduce the greenhouse gas emission which will be very difficult to do so because of the world population which estimates to about 8 billion people and very soon it will become 10 billion people, sea levels are still going to rise [3]. Urban cities and their spaces play a very important role in planetary urbanisation with politics, economy, social life, culture and environmental conditions being the influencing factors [4].

2 FLOODING

The major impact of global warming is sea level rise which will have adverse effects on the coastal cities leading to its disappearance (Fig. 1). This has been a major environmental concern because from 1900s the flooding has been increasing gradually with impact being severe between 1981 to 2010 and its from here its gradually increasing till date. In 2010 approximately 178 million people were affected by floods and the economy losses incurred

Figure 1: Impact of flooding.

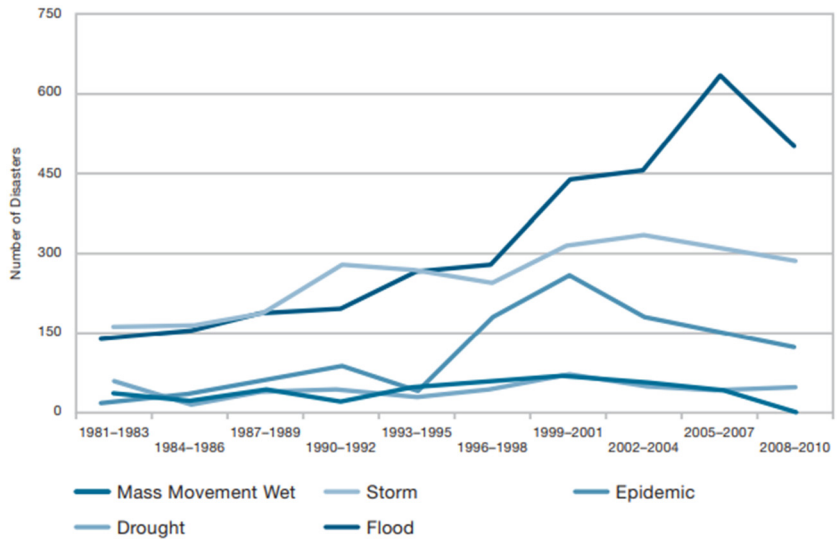

Figure 2: Global data of flooding and its effects between 1981–2010.

between 1981 to 2010 was over 40 billion dollars [5] (Fig. 2). The year 2021 the economy losses incurred was over 112-billion-dollar due to floods which means the flooding and the economy loss is increasing thrice the rate of the previous decade.

3 FLOOD RISK MANAGEMENT

Flooding is a disaster which affects urban environment in a huge way. Over the years a lot of research has been done to tackle flooding. From the early 2000, number of design methodologies have been surfacing in the context of tackling floods. The main idea behind the innovation of these methodologies is that flooding is inevitable because of the sea level rise so adapting is the best way to approach the disaster so thereby instead of looking at it as a disadvantage its better we find ways to prevent and adapt to flooding as well plug it in the urban environment in such a way that it becomes part of the urban setting.

Below are mentioned few design methodologies that tackle flooding.

3.1 Sponge cities

Sponge cites are a type of cities which are designed mainly to tackle flooding issues. The interesting part about this design methodology is that the disaster is very swiftly made into an advantage which ultimately contributes to the urban environment. Ideally floods cause damage but in this case when it floods the water is absorbed and then recycled so that it can be used for urban activities. When the city gets flooded it acts like sponge and absorbs all the water which are stored in urban aquifers before which it is filtered through the soil [6] (Fig. 3). This methodology is a practical solution for flooding.

Figure 3: The Wujiang river in Zhejiang, Yu's home province.

3.2 Floating eco-homes

Floating Eco-Homes-Harnaschpolder is a project a residential building built in the water retention area of delft where the main objective was to construct homes on water by using energy efficient systems and sustainable design approach to reduce the impact on the environment (Fig. 4). A distinctive design feature of this project was that the citizens own a plot on water. These successful small-scale projects gave the architects and urban designers a boost to use the developing technology to their advantage to design self-sufficient floating cities which propagates off the grid habitation. The water quality is checked by the water measurement program using underwater drones. This experimental project was built in a flood prone area, where only 6 houses were built to check whether this design methodology worked, and it turned out to be successful because it tackled flooding and the residents were very comfortable as they didn't feel any stress staying in the floating home.

3.3 Floating Pavilion, Rotterdam

The "Floating Pavilion Rotterdam" was one of the most innovative projects done by delta sync which has become an international exemplar for its sensitive eco-friendly design towards the environment and for using sustainable design ideologies [7] (Fig. 5). It's an interactive conference and exhibition space which is designed in such a way that it acts like a bridge between city which is land and the port which is water. The pavilion is energy efficient; it gets heated and cooled down naturally without any artificial interference. The pavilion reacts with climate in such a way that it gets heated by solar energy and it cools

Figure 4: Floating Eco-Homes-Harnaschpolder.

Figure 5: Floating Pavilion, Rotterdam.

down with the surface water. This project was an experiment to analyse if floating buildings can be viable in an urban environment and can they replace buildings which are sinking due to the sea level rise.

3.4 Amphibious architecture

It's a design methodology which is used to tackle flooding. The building is designed in such a way that when the area gets flooded it will rise to water level with the help of a hydraulic system and then it will act like a floating building. This structure is built on four vertical posts with the floating blocks placed beneath the house, when flooding occurs the floating blocks lift the building hydraulically. This has been successfully implemented in many floods prone area starting from New Orleans [8] (Fig. 6).

Figure 6: Amphibian building, Orleans.

3.5 Floating cities

Floating cities has been in the limelight for a very long time as proposals, but none have been implemented, projects which have been implemented are small scale residences or pavilions which has become a strong foundation for the implementation of floating cites. These successful small-scale projects gave the architects and urban designers a boost to use the developing technology to their advantage to design self-sufficient floating cities which propagates off the grid habitation (Fig. 7). The aim behind the design of floating cities will be reconfiguring cities with innovative urban spaces and implementation technology innovations [9]. Floating cities can be a replacement for the cites that are sinking due to flooding.

Figure 7: Oceanix City – Floating city proposal by BIG (Bjarke Ingels Group).

4 WHY FLOATING CITIES?

Studies say if 13% of the human population start to live on water, humanity will achieve harmony with nature which requires 1% of the total ocean area. “Floating cities could be repeatedly remoulded according to the seasons or population changes” [2]. This enables flexibility in the expansion of the city with the urban development. Floating cities gives an opportunity to free the urban cities from the housing crunch by providing prefabricated low-cost housing on the sea which would create a cost-efficient housing [10]. Urban designers saw a potential to re-establish urbanisation in a more sustainable approach through the emergence of the floating cities as they would be designed on completely new sustainable principles. Self-efficient floating cities can also be the solution to the water–food–energy nexus and give an opportunity to create nations which will govern independently on the sea giving rise to ocean communities and ecosystem made by mankind that are designed to develop, evolve, and change with time and it would be termed as Seavilisation.

5 ARCHITECTURAL EVOLUTIONS OF FLOATING CITIES

5.1 Beginning of floating cities

The idea of Floating cities and design development evolved from the already existing floating villages like the Tonle Sap, Cambodia, Ko Panyi, Thailand, Uros, Peru, Day Asan, Philippines, Ha Long Bay, Vietnam and Ganvie, West Africa (Figs 8 and 9). These floating villages has been developed keeping its geography and climatic conditions in mind, but beyond the morphological conditions the social and cultural aspects has also influenced the development of the villages.

Figure 8: Ko Panyi, Thailand.

Figure 9: Ganvie, West Africa.

5.2 Influence of utopian architecture

The architectural projects done in the 1950s by utopian architects like Tokyo Bay Plan designed by Kenzo Tange in 1960 also called the “The Japanese Metabolists”, Buckminster Fuller’s Triton City and Archigram and Paolo Soleri which proposed underwater sea farms were few among the utopian projects which gave a platform for the current architects and engineers to think about making a floating city a reality (Figs 10 and 11). These projects worked around the fluidity of the sea which gave rise to floating cities designed in an organic way.

Figure 10: The Japanese Metabolists.

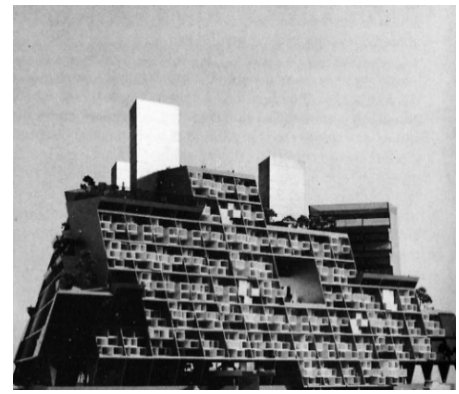

Figure 11: Triton City.

5.3 Emergence of floating cities

In the early 2000s, when climate change was seriously impacting the world and a lot of coastal cities facing its consequences from here came the urgent need to come up with solutions for the sinking cities. Few of the design solutions were that the building retention systems, displacing the coastal settlement or rising the settlement [11]. On small scales amphibious architecture and floating architecture was implemented. Using amphibian concept, the buildings were designed as such that it rises with the flooding and goes down when the water is drained out, this style was useful in zones where water gets drained after some time [9] (Fig. 12). The other one was floating architecture where the buildings are designed in such way that it permanently floats on the water, and this works in zones were flooding of the settlement is permanent (Fig. 13). Keeping the above aspects and implemented design methodologies the floating cities proposal emerged through merging, modifying and reassembling of different concepts with the available support of technology.

Figure 12: Waterloo, Ontario – NRC research pavilion (amphibian architecture).

Figure 13: Scoonship – A floating settlement built in Amsterdam.

6 SPECULATIONS ABOUT THE FLOATING CITES

Floating cites were speculated to become a market of governance. Instead of following the footsteps of global socialism, the floating cities will open a market of societies with different ideologies, culture, governing styles and political outlooks. Different societies can compete for citizens [8].

7 SOVEREIGN FLOATING CITIES AND MICRONATIONS

While designing a floating city every aspect has been taken into consideration but there is one aspect which doesn't come a long way in the vision which is the social political boundaries. The proposals don't specify under which governing authority or global government the city would come under which means it gives an opportunity for the city to build its own government with legal regulations formed based on the urban design, culture, lifestyle, economy and the local environment. So, the floating cites can have functional government body with social structures that are independent from external interference which will ideally be called a micronation. There was an experiment done called Principality of Sealand in the North Sea as it was claimed as an independent offshore micronation since 1967 [12] (Fig. 14). The platform is a military fortress called rough towers which was under British government during world war but now it's owned by the Bates family. This micronation has its own centralised government which is free from the external interference. The micronations can form the structure of the government in relation to the traditions of anarchism and libertarianism [13]. Instead of having districts, boroughs or states the floating cites will divided into ecological enclaves [14].

8 THE CHALLENGES IN BUILDING FLOATING CITIES

The main challenges floating cities would face in the implementation will be site selection and cost of construction which is turning out to be very expensive because of the state-of-the-art technology, sustainable materials and constructing the city as disaster resistant module which is very expensive. Since the population belonging to all the different economical categories in the cities must gradually settle in the floating city so thereby the housing should

Figure 14: Principality of Sealand.

be affordable, but the cost of construction is becoming an obstacle and eventually there is a possibility that the floating cities become an expensive development which is only exclusive to the elites with power, resources and money.

9 CONCLUSIONS

The implementation of floating cities will mark a new beginning for the future of urbanisation. Floating cites can freely actualize in a unified manner to maintain world order [15]. Floating cites as the power to change the geography of the world with new nations added. But behind this design proposal there is an aspect which is not addressed which is the impact on the marine ecosystem which is the most sensitive component of the planet. Covering ocean surface would bring risk to the marine ocean system because light plays an important role in the natural biochemical cycles and food chain. The latest proposal for floating cities does propagate eco-friendly design approach but the impact on the ocean cannot be ruled out 100%, thereby the impact as to be studied in detail to find adequate solutions, but this can be achieved only when it's implemented because nothing substantial will come out based on speculations. As time changes, we will gradually understand the impact of the floating city on the urban and environmental condition and analyse whether the path taken to design and implement the city is an eco-friendly approach but for now the floating city proposes to be the urban future that will be an exemplar for the other developing cities also a solution to urban issues.

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