The International Journal Of Engineering And Science (IJES)
||Volume||2 ||Issue|| 8 ||Pages|| 18-29||2013||
ISSN(e): 2319 – 1813 ISSN(p): 2319 – 1805

RAFTA2011, the Innovation Of The Manufactured Floating House Model: A New Concept Of Waterfront Settlements For Flood Risk Reduction In Indonesia

[1]Karyadi Kusliansjah, [2]Yasmin Suriansyah
[1]*(Doctoral Candidate in Architecture Department of Parahyangan Catholic University, Bandung, Indonesia).*
[2]*(Doctoral Candidate in Architecture Department of Parahyangan Catholic University, Bandung, Indonesia).*

---ABSTRACT ---
The influence of global warming appears to worry to the world and Indonesia, especially the effects of floods happening at the riverside that potentially cause losses. Indonesia is an archipelagic country threatened by such a risk because its geographical zone is spread across a very active tectonic area, beside it the longest beach having some waterfront settlements in 300 cities located near rivers or coasts. Most of the dwelling houses in the areas are kampongs, stilted houses, and marginalized traditional floating houses.This study is intended to contribute to risk reduction of floods, through manufactured innovation in RAFTA2011's floating house model, and develops a new setting of waterfront settlements that are healthy, safe, ecological and relatively inexpensive. The research outcome supports integrated design development and opportunity for growth in new related industries. RAFTA2011 based with qualitative-quantitative design research methods at Martapura riverside in Banjarmasin, supported by The Higher Education-Kopertis-4-DP2M, Competitive Research Grants Programme.

KEYWORDS: *Floods, RAFTA2011, Riverside, Banjarmasin.*

Date of Submission: 6 , August ,2013 ⟷ Date of Acceptance:25,August ,2013

I. INTRODUCTION

Natural disasters such as flood and earthquakes have occurred more frequently in Indonesia lately. These disasters have caused considerable losses and are a burden to both the affected communities and the government. Natural hazards need to be considered by various parties. To find a solution to reduce the burden of the loss, they need tips and innovations of academic concepts.

1.1.Environmental Balance, Control of Natural Disasters.

The effect of global warming and tectonic seismic activity has become a cause for alarm all over the world. This impact has increased flooding in coastal and river banks. This feeling of anxiety stands to reason for Indonesia. The result tends to drown out most areas of the water edge. Two of the basic reasons are: 1.Indonesia is an archipelago that has the longest beach in the world. The geography consists of a highly active tectonic zone. This is due to three major plates of the earth and the nine other small plates that meet in Indonesia. The meeting formed pathways of complex plates. Interaction between these plates positioned over Indonesia as a potential area is highly prone to earthquakes. [1] 2.Since the beginning of human civilization is likely to evolve in the waterfront area, such as a river, lake or ocean. The edge of a pedestal region becomes the main human settlements. As a result of global warming the tide gauges, as well as may increase change the cycle of the seasons. In recent years the impact had the power to sink the water's edge deep into the ground. Other causes for worry include the projects that considerably worsen the natural balance of the decline. Habits of forest conversion have caused deforestation in the headwaters. Compaction of development on the banks of the river cause the river has shortened body. All discharges of waste water and rain water tend to flow directly to the river. The fact above is likely to make the waterfront an area prone to floods. If a natural disaster occurs there, it certainly raises the material and non-material losses for society. To control natural disasters, especially on the very edge, spatial policy developments need to be considered.

1.2. Threatening Flood, City Need Solution

Banjarmasin is the capital of South Kalimantan. This waterfront city is known as the city with a thousand rivers. The city is located on the banks of the Barito which the biggest river and cut by the Martapura river. The lowest city height was 16 cm under sea level. The city condition became flooded due to the effect of the hydrodynamic flow in the Barito river and ocean tides, thus influence to the land makes this city very critical sinks when extreme flooding attack. Within constraints these puddles are inevitably unavoidable for the river city. Given the changes in extreme natural environments, it becomes a challenge for a revolutionary architectural design to create a new concept for living in the water environment. The waterfront settlements need a new innovative concept, to design waterfront villages with many floating houses and conducive urban infrastructure sufficiently equipped to deal with the extreme tide.

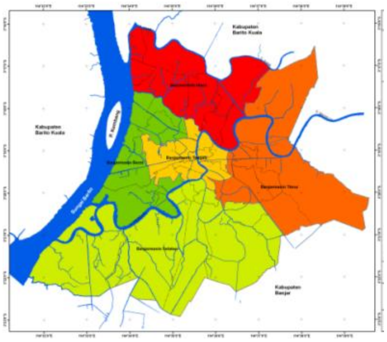


Fig.1.Banjarmasin city map
source: Bappeda Banjarmasin,2009

The research purpose is to find a new architectural design solution for prone waterfront areas. The results of this study are innovative designs for a floating house model to be manufactured. RAFTA is an abbreviation for the riversides. This innovation is also expected to contribute to society in Indonesia's critically flooded regions. RAFTA becomes an option for a model for waterfront housings today, which can reduce any level of losses due to flood in safe, healthy and ecological. RAFTA innovation research has developed typical traditional floating houses for a model on the banks of the river Martapura in Banjarmasin. The RAFTA model is recommended as a solution to many waterfront cities in Indonesia and as a new concept for developing the waterfront settlements, particularly focusing on the problems faced by tidal banks that face extreme conditions, being exposed toflood-prone fluctuations (not the flash floods or tsunamis).

1.3. Research Problems

Two challenging research problems are: 1.On a macro scale, such as the implementation of regulatory policies on spatial and urban development; 2.On a micro scale, such as architectural design innovations for housing on the river banks which is extremely flood-prone. From the above problems the following research questions can be formulated:

(1).What measures can be taken to reduce the level of natural catastrophe losses for people in flood prone areas in Indonesia riverbanks?

(2).How to support the improvement of quality and services of providing healthy houses that are safe, ecological and relatively inexpensive on the river banks?

(3).How can the shape of the RAFTA model innovations be in accordance with the requirements stated in question 2 above?

1.4. Research Objectives and Benefits

Objective: Conduct on architectural academic study of waterfronts to find solutions for city housing problems on the river banks and develop a new innovative concept for manufacture of the floating house model (RAFTA 2011). The house model is conditioned to face extreme floods and earthquakes, especially on Indonesian river banks. It qualifies as a healthy, safe, ecological, and relatively inexpensive house, which is effective for: 1.The residents of waterfront villages, such as fishermen, shrimp farmers, ranchers, farmers farming, farmers and miners, rock salt miners and the like. 2. The base camp officer for field research activities, mining exploration or estuary guardian, or a protected forest on the edge of the water / river. 3.The flood refugees after the natural disaster, for the quick provision of shelter. Architectural studies objects and observes water village contexts located on the river banks of the Martapura river, Banjarmasin water city, South Kalimantan. Benefits of product development in an integrated RAFTA 2011 model for many of the

following are:

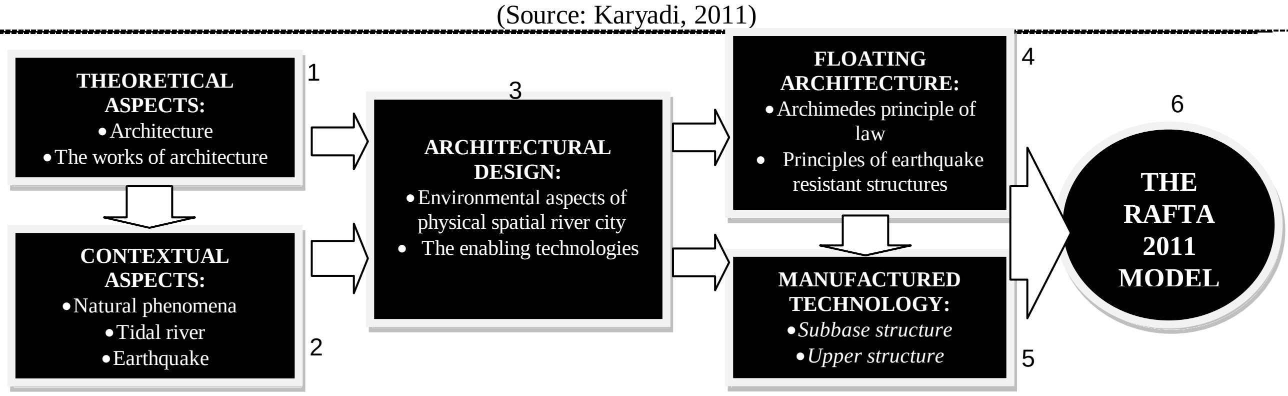
(1). For the community: - As healthy floating house choices that reduce losses at flood prone areas. - Open new jobs in the floating house component industry, for expeditions, field technicians and so on.

(2). For private investors: - Develop technology for the floating house industry and the market prospects, - Provision of the floating houses quality, health, safety, and ecological aspects.
(3). For the Local Government of the city: Increased Regional Budget Revenue from the city taxes and levies sector; Support programmes to create new jobs; Improve environmental quality in integrated and development efforts to flood prone riverbanks in an orderly fashion.
(4). For Cooperatives: Providing healthy housing through alternate social gathering for members of the cooperative enterprise; Being a sub-field of cooperatives of fishermen,fish farmers; Providing healthy homes through alternate social gathering for members of the cooperative unions, and so on.
(5). For the Banking sector: Distibution of industry, investor, suppliers capital loans; Distribution of cooperative capital loans; Distribution of housing investment loans.

II. METHOD

Attempts to answer research objectives through innovative architectural design using quantitative and qualitative methods for interpretative design by research have been applied. Stages of the research and design of this architecture are as follows: 1. Studies and comparative literature, to find information and insight

Scheme 1. Approach and Innovation of the Architectural Design Research
(Source: Karyadi, 2011)



into viable technology; 2.Observation of field problems, data collection at the site; 3. Exploration, assessment and testing the feasibility of the main material for the innovation model; 4. Preparation of design concepts for RAFTA models, for flood-prone riverbanks; 5. Designing pre-plan RAFTA models for the study sites; 6. Calculation of the structure and buoyancy RAFTA models, the burden of exposure to tidal waters and winds at the sites; 7.Making animation and design mockups of RAFTA models; 8. RAFTA development of design models; 9. Making mock laboratory test models of RAFTA; 10. Preparation of research reports and RAFTA design models; 11.P ublication of research results through seminars on RAFTA models in architecture journals. This activity is approached through: 1.Theory; 2. Context; 3. Architectural Design, to: Aspects a): forms and natural phenomena; Aspects b): of the physical environment of urban spatial streams; and Aspects c): enabling technology.

2.1. Theoretical Approach

The essence of architecture is the art and science of constructing buildings. Architecture is made possible by the desire of man in space to explain its order through building forms in the broadest sense[2.] A work of architecture is a synthesis of the various forms of restrictions and possible opportunities in the design. There are three steps to be taken by people to establish their built environment[3], namely: 1. People nust realize their built environment in accordance with the understanding of the natural surroundings. 2. People are encouraged to complete sections that are considered less than perfect, so as to achieve a satisfactory level or one deemed fit. 3. People tend to use symbolism to elevate their understanding into a more general level, by means of new media.Through these three steps, the meaning of a place is created. That is the kind of place that gave birth to the identity or characteristics of a place, or a place that has a certain spirit. As Schulz was thinking about the sense of place and the genius loci, the context of the river city is supposed to be felt in the lives of architecture and city layout. A theoretical approach builds a foundation for understanding the relationship between the medium of places and the medium of architectural works. A distinction should be made between architecture and works of architecture. An architectural work is a synthesis of architectural design decision results elaborating the concept of reflection to the context of a place and the location of the natural environment where the architecture is located. What is the relationship, between the medium condition and one another's, supporting the realization of alternative forms - functions – constructions. The theoretical approach is applied to the design concepts, conducive to extreme floods on the riverside of Banjarmasin city.

2.2. Contextual Approach

Space will be meaningful as a place if the context of local culture is taken into account[4]. This understanding is necessary for the physical design of a certain place. The river is a natural formation that divides the mainland, and may be the primary element of a city structure. The physical-spatial meeting place for water and land is a boundary (edge) called the waterfront. The character of the surface of the water's edge is the slope of the water bodies ashore. So there is a physical space that is flooded and others that are dried in the form of land. The spatial context restricts and gives an opportunity for architectural design. The attitude of the architectural designer to architecture of the city to the river should assess the typology of buildings and locations conducive to the character of this nature. This contextual approach will be made through three particulars or circumstances:1. Natural phenomena; 2. Plug-low tide conditions; 3. Earthquake-related conditions.

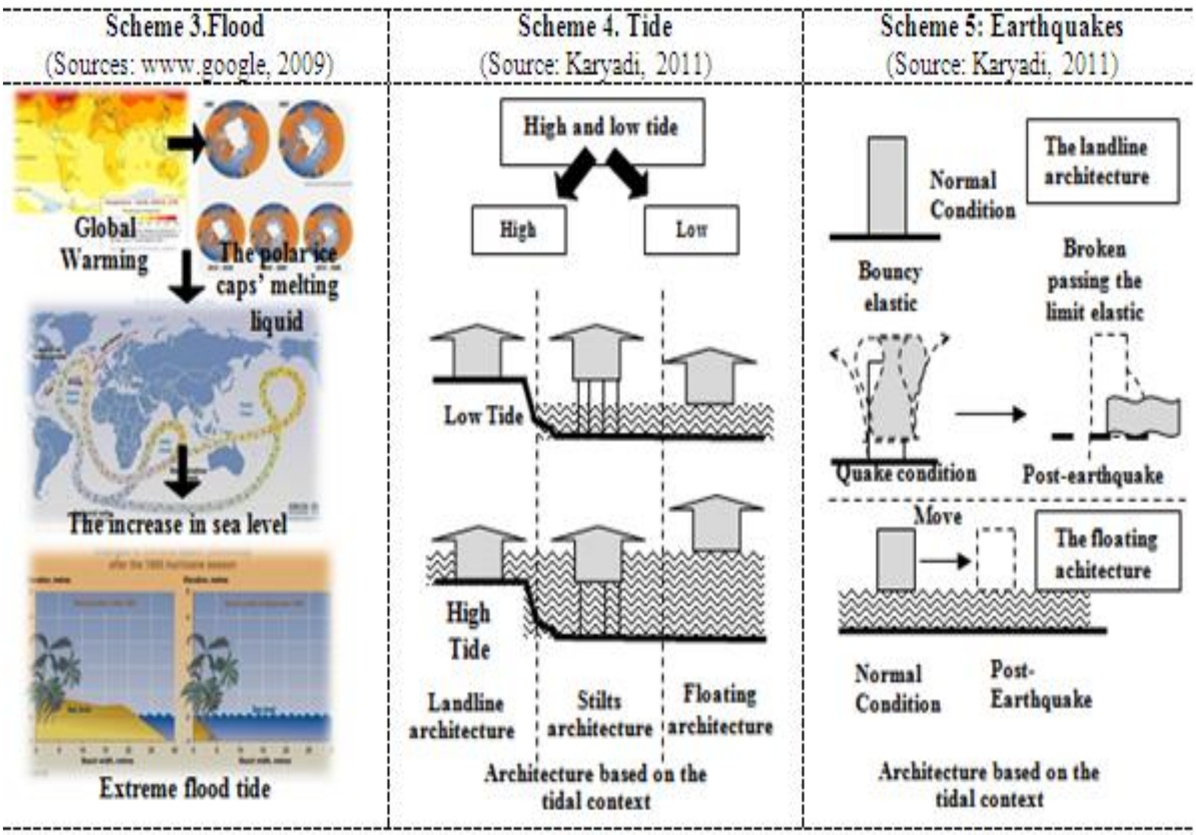
2.3. The Banjarmasin City Contexts

Banjarmasin city is divided into parts by a river, namely the large river Martapura and some medium and small-sized rivers, as well as a number of the city's canal systems (Banjar tradition distinguishes these as Anjir, Handil and Saka), which has been built by J.J.Meijer since 1890, in the era of Dutch colonial government. The physical context of Banjarmasin city is a the lowland (16 cm below the surface of the sea) and tidal conditions positioned high and low the water surface of the river caused by the effect of the hydrodynamic Barito river flow to branches of the river's tributaries. The water rises and the overall environment is partially submerged low under midnight tide conditions, eliminating the territorial limits as boundless. The image quality of the living environment's physical shape if receded is significantly different in the daytime and in the evening, the position of the river's low tide. The tidal environment fields two urban characteristies (wet and dry), because there is no city water management system. Architectural design important to noticed this context tidal, for positioning the height limits and building materials dry decent there. Their people had long been part of a culture dependent on aquatic life from the transport of water, floating markets, shower-toilet-washing, to live on the river, and on the banks of the river or on land.

The *lanting* house is traditional floating house of architecture typology in this area, in addition to its architecture of houses on stilts along the banks of the river. Both types of floating houses and houses on stilts are a form of the Banjar residential community's attitude towards tidal river, each day commemorate local settlements, due to the hydrodynamic pressure effect of the Barito river flow, which affects all boils down to the river there[5].The phenomenon of flooding had already become a regular customer to this city throughout the year. Flood prone areas in the city are inevitable since the tide submerged due to global warming. According to the study, the projected sea level rise will increase from the year 2010, 2050, up to 2100, will rise 0.934 meters from the present, which tends to eliminate 115 islands located in Indonesia, including the third city of Banjarmasin[6]. The predicted spatial physical city will be faced with a flooded neighborhood domination. Mainland cities will have high density and should be utilized more efficiently, to support the need for agricultural land.

2.4. The Role of Architectural Design Confronting Flood Disaster-related Phenomena

The development of Banjarmasin city has tended to change the culture of aquatic life to landline life culture. The river's spatial orientation and water transport have been replaced by access roads. The river also tends to bear the brunt as the city and residential waste disposal become shallower. Techniques to build houses people tend to turn away from the water to hoarding soil under the house to raise the surface. The conditioning has constricted and eliminates the city's canal system leading to eliminated tributaries, due to trapped water (breaking up the flow of the river). The soil-bound architecture has become the severed people's choice as a trend to build their houses in the city. Another aspect is the difficulty of local communities in getting material logs to pads floating houses and wooden poles for the home underpinning, due to the high price, which caused people to switch to homes made of cement. The architectural floating house type also tends to be abandoned as an option for building houses.



If floods submerge the land, living in the water returned to space of choice architecture development in river city that are prone to be submerged. The problem is how to address the architectural paradigm of place in the context of floods? Architectural paradigms attached to soil-bound places (such as houses touching the land) are no longer suitable for flooded regions due to tidal conditions. The type of stage house becomes limited to high scantling stages. If the water level continues to rise extremely, ultimately the limit of the stage floor will be flooded as well. Just imagine the urban special phenomena bound to occur if the solution to hold out against floods only consists of continuously raising the masts for houses on stilts or else to survive by erecting dams and artificial hydrological entities called *polders.* Conceivably, urban spatial phenomena that occur, if only the dissolution continues raise houses on stilts or survive to build dams and polders city. How much energy will this take and what is the cost to the community and city management? A number of questions related to architectural design and architecture of the city need to be addressed to find a solution for this case. How physical spatial structure of urban space and architectural form of houses stage must address the phenomenon when the tide happens to be more extreme? How should access be positioned from building to the road network and other cities? The three schemes 3, 4 and 5 below illustrate the formation and natural phenomena, the effect of the floods and attitude towards architectural design tide and earthquake. Natural phenomena causing extreme flooding of the influence of global warming, illustrated in scheme 3. Schemes 4 and 5 show the type of architecture that is more conducive to buoyancy and one that would minimize the risk of the condition of flood and earthquake oscillations.

III. RESULTS AND DISCUSSION

3.1. Architectural Design Approach

The architectural design approach analyzes several aspects as follows: 1.Spatial physical environment of water-city, and 2.Conducive technology, to gain the alternative of the floating architecture model appropriate to the Martapura riverbank, Banjarmasin. Observing settlements along the Martapura river banks fields, three categories of residential architectural order forms that characterize the city's architectural and cultural environment, nomelly: 1.Applying the context of water-land, the architectural order based on aquatic life with the architectural typology of floating houses, such as a *lanting* house (Banjarese traditional floating house). 2.

Adapting the context of water-land, the architectural order that regards the river only as part of the spatial orientation of the house, for example lifted houses lined orthogonally along most Martapura riverbanks, Banjarmasin. 3. Controlling the context of water-land, the architectural order is not oriented toward the river but to the land and only employs the river as drainage and accommodates waste disposal. Settlements on the banks of the river and likely formed by water villages consisting of a row of raised houses with a proximate and solid order, oriented to the road or the '*gertak*' as wooden bridge and turning or facing the river space. This arrangement is affected by the river tidel. Construction of the stage or raised houses is supported by quite high columns.

The threat of an extreme flood condition being higher than the supported column height, this house will certainly be flooded. The observations show the development of the raised houses environment into the wet, muddy, dirty and unhealthy, environment especially when the water recedes. The quality of this proximate and solid order is poor, because it was built by random, spontaneous patchwork, which closes the view to the river from the road, and became susceptible to fires.

3.2 Floating Architecture

Floating architecture is the architecture capable of floating in the water and maintaining a functional floor height above the water surface when exposed to high tide or flood. Floating architecture categories evolved from the typological floating house, ranging from floating settlements to the typological floating city. The floating house is typologically a from of buoyant residential architecture that can float on the water surface, such as a raft house, *lanting* house on the Martapura River, floating houses, or amphibious houses in Holland. The type of floating house forms a potential to be developed to deal with the phenomenon of the increased threat of flooding as a result of global warming because it is easy to adjust the height position when floods strike, with minimal risk of causing material loss to the occupants.

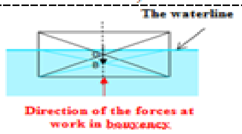
Floating house is not a ship. The floating house is an architectural product in principle related to its location. The location context takes into consideration orientation the spatial comfort arrangement for indoor and outdoor space of the houses for the residents. In tropical climates such as in Indonesia, the location context is an important consideration for the comfort of the room arrangement of orientation inside and outside spaces of the house. The orientation position of the sun in the area determines the zone position of all functional space and conditioning the coverage. For example, to make a decision of northward house orientation, the north facade will be positioned as the front of the house, as well as determining the order in which space functions. Thus the east side will be allocated for the room that requires the morning sun and the western side will be occupied by a space conducive to receiving warm afternoon sun. Similarly, the south side will be adjusted to the supported zone and services for the house. The attachment to a place establishes the principle of architectural design leading to decisions. It is not the same in designing a ship or vehicle positioned to move freely, changing orientation in all directions.Based on this principle, architectural paradigms either define an architectural work or not. Therefore, architectural design of the floating house must be bound to a certain place. If the water as the architectural built environment then let the water become a part of the floating household life, which bring forth a distinctive water-bound local culture.

3.3. Traditional Floating House Buildings in Indonesia

Kalimantan floating houses models are known as *lanting* houses, that is a traditional raft house the Banjarese in South Kalimantan with a floating rafts foundation built on a structured arrangement of large trees trunks, and always locked by waves from ships going up and down the river. Current *lanting* houses (a few were found in the Martapura River), can still be found inhabiting many other rivers of Kalimantan. Similar types were also found in the Musi River in Palembang, South Sumatra, or Batanghari River Jambi, as the Raft House. The *lanting* houses on the Martapura river Banjarmasin are known to have the following characteristics: 1.A shaped gable ridge; 2.A float platform of three large log trunks; 3.A base floor construction above an ironwood girder located above a pumice base; 4.The wall of boards or *kajang* (sunshade of bamboo laths or palm thatch), which are: woven palm leaves or bamboo laths; 5.Traditional floating houses moored on the river banks of *gertak*, whose condition is now likely marginalized, the less sought after by people who are turning to a landed-house type. Constraints faced by residents to build traditional floating houses are difficulties in obtaining large log wood to make a floating bearing, in addition to the high price. Efforts to replace pads with floating bamboo did not last long. Another factor is the policy of building setback lines border along the river implemented by the municipal city government, which has complicated floating house development along the river.

3.4. Principle of Floating

Scheme 6. Floating balance principle of Archimedes'law
(source: www.google.com, 2010)



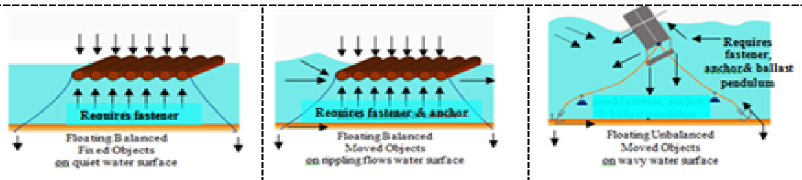


Fig.2. The mechanism of occurrence of waves and floating objects on the water surface
(Source: www.google.com, 2010)

The driving vertical force is due to the weight of an object on the water, such as archimedes' principle: any object, wholly or partially immersed in a fluid, is buoyed up by a force equal to the weight ofthe fluid displaced by the object[7]. the balance principle applies to the floating house. the float condition is due to of the enforcement balance of vertical force, and will experience movement or shock by tensile lateral force due to river water stream pressure or flooding. The water surface is dynamic, whose condition is greatly influenced by the flow of its generator that causes the horizontal and vertical thrust force. The horizontal thrust is caused by differences in elevation, the wind blowing on the water surface that bring forth the flow of waves, and also generated by moving objects (boats, and so on). The tensile force of galactic objects, especially the sun and the moon to the earth, generates the tide of the sea, or the extreme by *tsunamis* that occurred because of volcanic eruptions or tectonic earthquakes at sea. Dynamic conditions of water surface influence the forces that strike to floating objects in the water, as shown in the following scheme 6 and figure 2.

3.5. Conducive Materials in Technology Development for Floating Houses

The growing industry of construction materials potentially can be exploited for the development of the floating houses type today. Exploration of building materials alternatives to obtain the type of insulated polyurethane foam (PU) panels, which meet the RAFTA criteria, namely: 1.It more have: light, heat and cold insulation elements; 2.It must lot easy to set up: spliced, giving a visually clean impression, easy to maintain; and 3.Ecological aspects: environmentally non-polluting, water resistant and impermeable, non-corrosive; 4.Security aspects: strong, durable, non-flammable, and 5.Aspects of the market: easily available and relatively inexpensive, having been in mass production as a building material on the market. This material can be developed as the RAFTA innovation model, which has now been produced domestically (in Indonesia). The form of panels that have been tested, as a product of *the World Isopanel* that has been applied to be manufactured for telecommunication shelter, cool storage and its like, and which can be assembled quickly. Components of the material and model construction of RAFTA 2011 are as set out in Table 1 bellow.

Table 1. Materials of RAFTA 2011
Source: Karyadi, 2010

Sub-Structure Material of RAFTA 2011		**Upper-Structure Material of RAFTA 2011**	
Floor construction	*Galvanished Steel*	**Roof**	*Zinkalume*
Anchor	*Galvanished Steel Ring Pipe*	**Roof Truss**	*Light steel Construction*
Floating platform	*PVC*	**Ceiling**	*PU (poly urethane) panel*
Reservoir	*PVC*	**Wall panels**	*PU panel*
Bio-septictank	*PVC*	**Floor panels**	*GRC Panel*
Platform pad	*Galvanished Steel*	**Bridge accesses**	*Galvanished Steel Ring Pipe*

Fig.3. Anatomy of RAFTA 2011
Source: Karyadi K. et al, 2010

3.6. RAFTA 2011 Model

The RAFTA 2011 Model is an innovation design of the floating house model for the waterfront, which was built as assemblies of manufactured production parts able to float and maintain its functional floor height above the water surface, when exposed to high tide or flood. This RAFTA model is also conditioned to stay bound up on the environment order in the formal orientation and formation, and in addition no physical damage is caused by national disasters, including the impact of earthquakes (not tsunamis). Lightweight and easily transportable, it can be built quickly and when mass produced it is relatively inexpensive

3.7. Innovation Design Concept of the RAFTA 2011 Model

The concept of the RAFTA model innovation responds to all of the threats of flooding and improves the quality of the order and the building of settlements on the Martapura river banks, Banjarmasin. The RAFTA 2011 model innovation includes research and design of RAFTA's systems and components, such as:1.*A spatial system*, a study of the needs of minimal space area for activities, relationships and organization of space, requirements of residential space and ecological environment; 2.*A structure system*, a structure of calculations, buoyancy, construction system study, covering the terms of strength, balance and stability in flexibility, security against local climate conditions, floods and earthquakes strike (not a tsunamis); 3.*Materials system*, a study of the model is major material alternatives, which meet the criteria of design innovation aspects of waterfront architecture; 4.*A utility system*, a model of installation, flexibility and elasticity of the network (such as network and water tanks, sewage tanks, toilet sewage tanks, drainage, electricity, and waste disposal); 5. A *manufactured system*, a study of the production technology of the proposed design of RAFTA building components (sub and upper structure) and joint-construction systems between building components, such as: holder base components and binder anchor systems, floor panel components, construction of building frame components, wall panel components/space partition, door-window components, ceiling components, roof truss components and roofing components; 6.*A construction system*, a study of techniques to build and assemble the components in the field location, and the ease of transporting, lifting and packing material from transportation risks. The scope of RAFTA includes the design concept; *Macro scale concept*: RAFTA settlements arrangement on Martapura river banks; *Micro scale concept*: RAFTA 2011 unit.

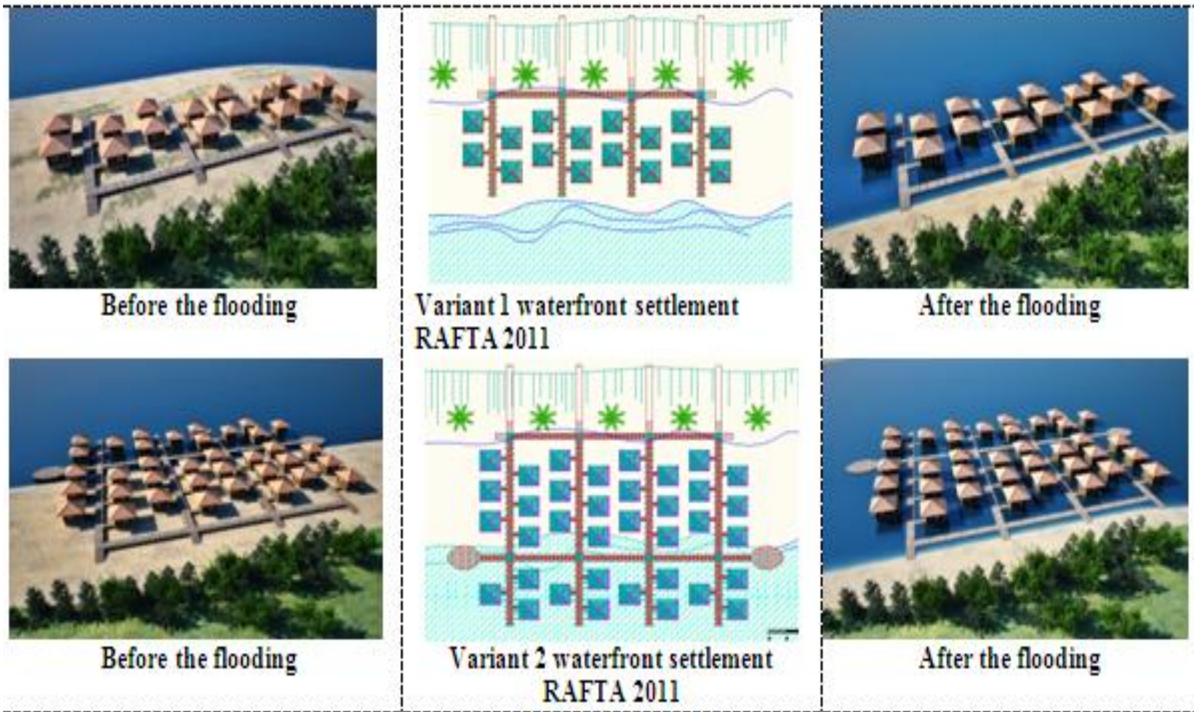


Fig. 4. Variant of RAFTA 2011 site plan in Martapura River bank – Banjarmasin
Source: Karyadi, Elfan, Gita, 2010

Macro Scale concept, a design concept of the RAFTA innovation model's settlement arrangements are expected to provide a solution to the problem of the Martapura river banks order, namely: built up as a tight and solid structure that closes the view to the river from the land, and saturated condition which is dirty and not ecological. The settlement concept of RAFTA 2011 solved the problem of these environmental quality constraints and weaknesses. Criteria for the waterfront settlement formation (Variant 1 and Variant 2): 1.The form of the waterfront settlement unit is a cluster with the capacity of RAFTA 16-32 units; 2.Non-tight arrangement provides open space between the building from the land into the rivers and the ecologically conditioning maximum sunlight to the bottom of the building in the water; 3.Being able to anticipate the flood, the cluster structure is conditioned to go up and down automatically. 4.Ecological waterscape, government and RAFTA residents are required to develop the culture of water and maintain the river between the units; 5.Access to housing through the

floating bridge and *gertak*, patterned perpendicularly from the road ended at the river dock to tie up the boat and socializing space. For variant 2 is equipped with a connection among the floating bridge on the river. 6. RAFTA units are complemented with bridge accesses, which are moored to the floating bridge. For each mooring unit available electrical connections outlet and water supply through a flexible pipe, the network is propagated along the bridge from the land.The concept of the RAFTA waterfront settlement order proposed two models: Variant 1.RAFTA is on the river banks and variant. 2. RAFTA combination is on the river banks and in the river. The results of the residential design development of RAFTA 2011, are shown in Figure 4.

Micro Scale concept: The innovation concept design of RAFTA 2011 unit models is expected to provide solutions to marginalized problems of the floating house type, and improve the quality of thespontaneous raised houses type on the Martapura river banks. Design concepts of RAFTA unit implement the three architectural principles, flooding environmental context, and technological innovation of industrial building components, namely:1.Architectural paradigm bound place; 2.Taking into consideration the environmental aspect on the banks river that and up and down due to the tides and floods; and 3.Using the principle of self-assemblage from fabricated components, to facilitate the distribution of the RAFTA,using general goods transport vehicles to the site. Design concepts are divided into two: 1.Concept of sub-structure; 2.Concept of upper-structure. The criteria for sub-structure concept are: 1.Bound to place; and 2.Being able to float when the tide strikes and turns down back into its place when the water receded. The results of sub-structure design innovation of RAFTA, designed not to use foundation and poles, but using: 1.A floating platform; 2.A pad for the floating platform; 3.An automatic anchor; 4.Fastener in the ground of river, in order to stand still. In sub base construction is placed: 5.Ground reservoir; 6.Bio-septic tanks and networks using flexible pipes. The criteria of upper-structure concepts are: 1.Floating houses whose minimum standard size is T-22: 2. Space program consists of: a living room serves as a multipurpose room, completed with pantry of a 2.3 x 4.6 m^2 areas, a bedroom of 2.3 x 3.5 m^2 area, bathroom and toilet of 2.3 x1.1 m^2 area. 3. Upper structure construction consists of principally the assemblies of manufacted components made up of these components: 1 floor panels, 2. Non-structural columns and beams, 3.Wall panels, 4.Doors and window frames, 5.Roof skeleton, 6.Ceilings tile, and 7.Roof cover.

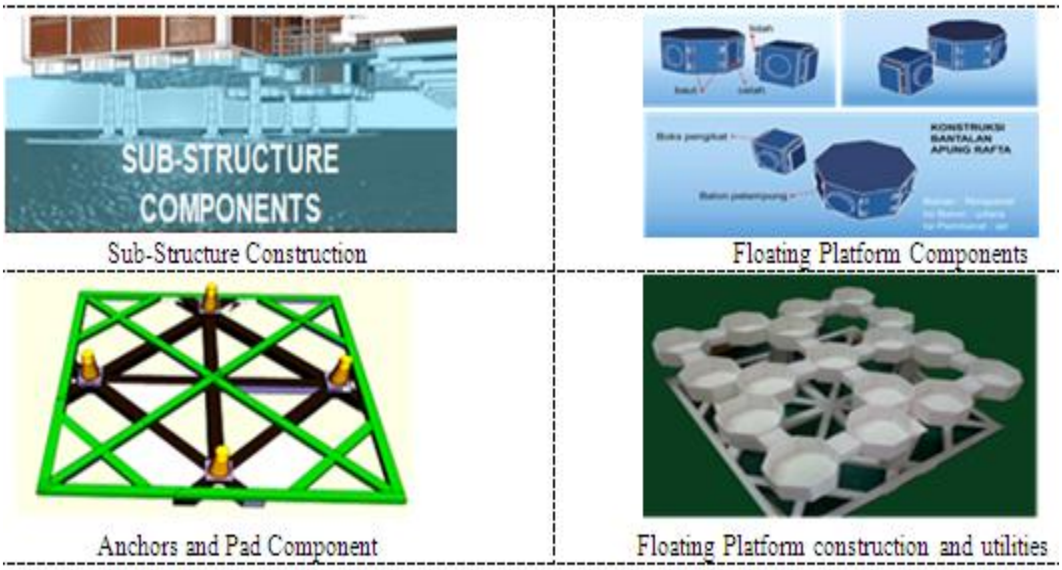


Fig.5. Sub-Structure Construction Component

Source: Karyadi, Elfan, 2010

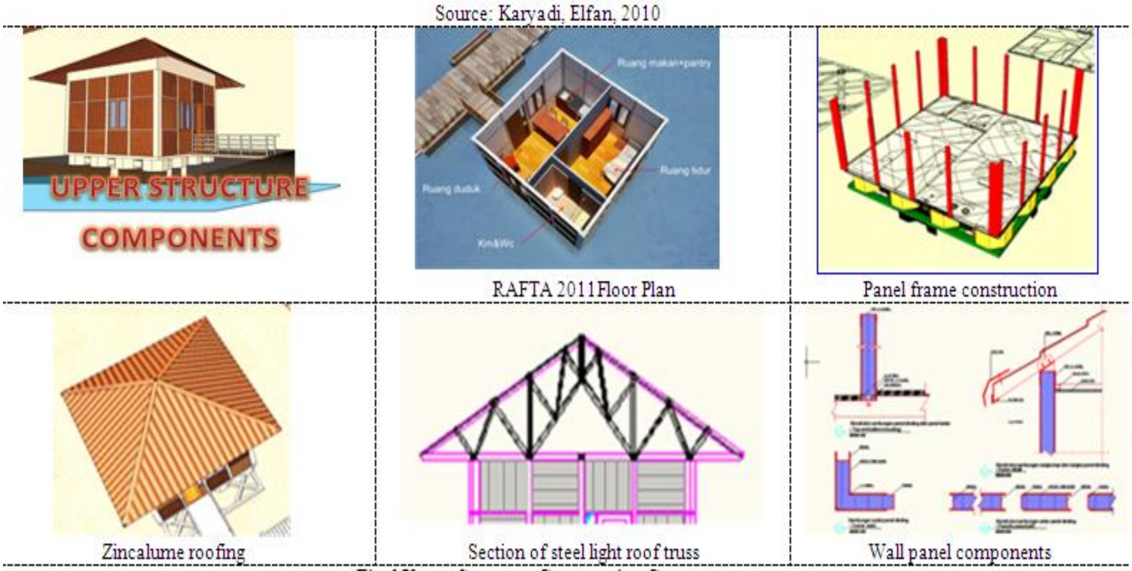


Fig.6.Upper-Structure Construction Component

Source: Karyadi, Elfan, 2010

3.8. Innovation Design of RAFTA 2011 Model.

The results of innovation proposed two variants of the RAFTA 2011 model for flood-prone water residential on the Martapura riverbanks, Banjarmasin in South Kalimantan, Indonesia, namely: 1.A new architectural design of floating house is the RAFTA 2011Model; 2.Sub-structure construction components of the RAFTA 2011Model; 3.Upper-structure construction components of the RAFTA 2011Model; 4.Variant 1 waterfront settlement for the RAFTA 2011Model; 5. Variant 2 waterfront settlement for the RAFTA 2011 Model.

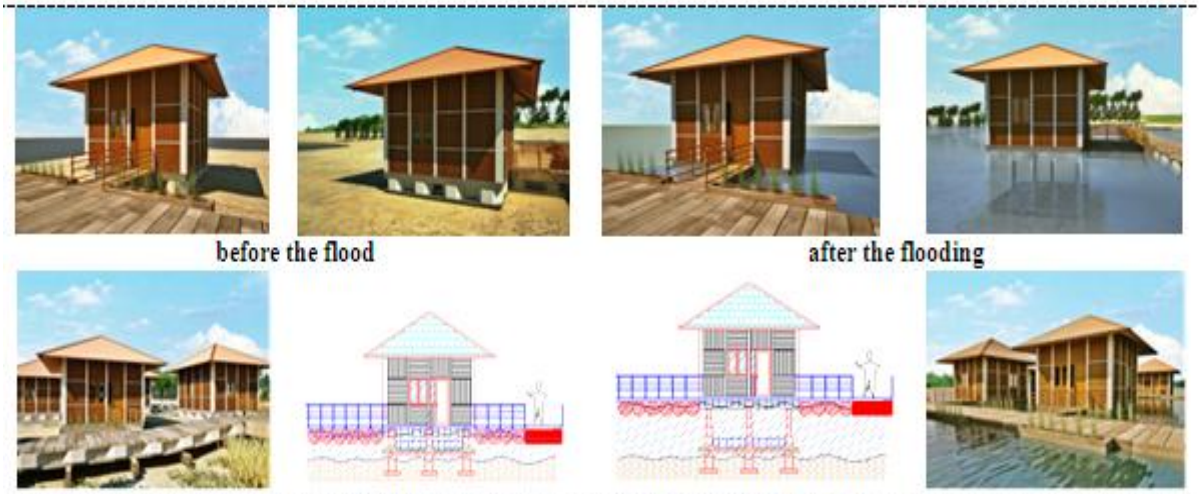


Fig.7: Innovation Design of RAFTA 2011 Model
Source: Karyadi et al, 2011

IV. CONCLUSION

4.1. Macro Scale:

Policies for spatial development of the city on the river banks needs to develop a water management system of the city, no longer following the tidal fluctuations that lead to more extreme situations. Keep the city's canal system restoration and construction of the canal in the right place. Develop the residential order of RAFTA 2011 as well regulate the tight and solid raised houses or spontaneous houses in flood-prone riverbanks.

4.2. Micro Scale:

The solution can be supported from the research result of innovation design of RAFTA 2011 model, to answers the research questions above, as follows:

1. The RAFTA 2011 prototype, as new design concept to reduce the level losses of natural disasters for waterfront settlements on the Martapura river banks, in Banjarmasin.
2. The RAFTA 2011 prototype can support the improvement tradisional floating houses quality to healthy safe, ecological and relatively inexpensive, and socialize it with the local city government.
3. Two variants shape of the RAFTA 2011 model as the innovations design of floating house model suitable for flood-prone riverbanks,
4. To develop industrial manufactured components of the RAFTA 2011 model and provide services.

ACKNOWLEDGEMENTS

This publication is a report on the final stage of the research results in 2011 for journals and seminars.On this occasion the authorial team wishes to thank:

[1] The Directorate Of Research And Community Service (DP2M) Of The Directorate General Of Higher Education, The Ministry Of National Education Of The Republic Of Indonesia,
[2] Coordinator Of Private Higher Education - Region 4 (KOPERTIS-4), West Java As DIPA Funders,
[3] Board Of Development Planning (BAPPEDA) Of Banjarmasin City, Settlements, Water Resources Planning Office As Sources Of Data And Information
[4] Research Institutions And Community Service (LPPM), Faculty Of Engineering And Architecture Department Of Parahyangan Catholic University, As Facilitator, Motivator And Research Team Builders.

ENDNOTES

[1] Irsyam, Masyhur, et al, 2010, *Peta Hazard Gempa Indonesia sebagai acuan dasar perancanaan dan perancangan infrastruktur tahan gempa*, Kementerian Pekerjaan Umum.
[2] Tjahyono, Gunawan, et al, 2009. *Sejarah Kebudayaan Indonesia*, PT.RajaGrafindo Persada, Jakarta.
[3] Schulz, Christian Noberg, 1980 *Genius Loci*, Academy Educations, London.

[4] Trancik, 1986, *Finding Lost Space Theories of Urban Design* John Wiley and Sons.
[5] Subiyakto, 2005.
[6] Susandi, Armi, et al, 2008 Proyeksi Kenaikan Air Laut: *Meteorological Studies Program, Institut Teknologi Bandung*, Bandung, Indonesia,
[7] Archimedes of Syracuse, 212BC *Archimedes principle*, www.archimedes.com, www.google.com, 28 Maret 2008,

REFERENCES

Journal Papers:

Astuti, House Improvement and Healthy Environment Workshops for Traditional Riverside Community, *Scientific Journal of Geomatics of PUSLITBANG PERMUKIMAN, Bandung, Bakosutarnal 1 September, 2008 Vol 11, 112-116*

Research Reports:

Kusliansjah,Karyadi, Tjong,Lydia F, Suriansyah, Yasmin, Kedmon,Elfan, *Inovasi Perancangan Arsitektur - Model Rumah Apung Fabrikasi pada tepi air, dalam menghadapi global warming-banjir-gempa di Indonesia,* Research report Competitive Research Grants Programme of The Directorate of Higher Education of The Republic of Indonesia (DP2M-Kopertis4), 2011-2010-2009

Chapters in Books:

Subiyakto, Bambang, Infrastruktur Pelayaran Sungai: Kota Banjarmasin Tahun 1900-1970, in *Kota Lama, Kota Baru: Sejarah Kota-Kota di Indonesia,* Jogjakarta: Ombak, 2005

Bappeda Kota Banjarmasin, Album Map, *in spatial plan (RTRW) Banjarmasin City 2011-2031*, Banjarmasin, 2009

Internet:

Global warming, www.google.com,2009,

Dutch floating breakwaters and floating structure technology, www.google.com,2010

Isulated Panel setara SIP ID 2000, Produk PT. Isopanel Dunia, Indonesia www.isopaneldunia.co.id, 02 April 2008

Analisa Pasang Surut, in Coastal Engineering, Tags: gelombang, laut, pantai, pasut (41) http://rahmat88aceh. wordpress.com, January, 2009.