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FLOATING ARCHITECTURE AS AN URBAN DEVELOPMENT AND ACTIVATION TOOL FOR WATERFRONT AREAS

The The article addresses the subject of employing floating architecture (FA) as a means of contemporary urban planning, with a particular focus on housing-related concerns. An examination of international case studies reveals the extensive potential for the implementation of 'floating' structures. The culmination of the theoretical and technical experimentation phase at the commencement of the third decade of the 21st century has facilitated the popularisation of this type of solution, not only as a response to the elite needs of sophisticated public utility architecture. In addition to unique commercial hotel projects on prestigious waterfronts, increasingly egalitarian housing projects are now being developed. Advanced structural forms, including derivative models such as amphibious architecture and boathouse architecture, have become a standard component of spatial planning methodologies in regions where conventional development approaches are not feasible due to a complex interplay of technical, administrative, and economic factors. In the current epoch, there is an ongoing discourse surrounding the adaptation of urban environments to the imminent challenges posed by climate change. Within this intellectual landscape, floating architecture emerges as a prominent solution, garnering serious consideration within a development strategy that emphasizes flexible resilience. Such strategies are particularly pertinent to regions susceptible to flooding, as well as to the conceptualization of artificial ocean habitats intended to serve as refuges for individuals displaced by the repercussions of climate change. The article presents the systematised results of the work of an inter-university scientific and teaching team on identifying the main trends in the application of floating architecture in the revitalisation of urban waterfront areas. The results were utilised in order to define the scope of two master's theses dedicated to the Gdańsk waterfront.

Keywords: revitalisation, water urbanism, floating architecture, affordable housing, housing on water, contemporary urban planning, port cities, climate change urbanism, activationof inactive port docks and waterwayss, waterfront redevelopment

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1. FROM EXPERIMENT TO PLANNIG TOOL

Floating architecture (hereinafter referred to as FA) is a dynamically developing branch of contemporary architecture and is a solution that is systematically taken into account in urban planning. Polish-language literature on the subject is dominated by publications on technical solutions, the environmental dimensions and the architectural form of FA structures, in line with the global trend of research into the so called *aquatic architecture*. Global studies on FA are dominated by an interdisciplinary research perspective. Their main focus combines technology with architecture and art, but is gradually being extended to related disciplines such as landscape architecture, environmental studies and spatial planning [Bujniewicz 2019 after Wylson 1986, Williams 2009, Burchard C., Flesche 2005 and Barker, Coutts 2016, Strangfeld, Stopp 2015, Dreiseitl, Grau 2005]. This is primarily a response by scientific and design communities to the issue of the effects of climate change, including, among others, rising sea levels. The urban planning approach to research on FA and its derivatives is also undergoing changes. Alongside aquatic architecture, the so-called *water urbanism* is becoming more widespread, sparking a resurgence of interest in this design approach, initiated at the beginning of the second half of the 20th century by the late Metabolists [De Meulder, Shannon 2008, Nijhuis, Jauslin, van der Hoeven 2015]. While architectural scale is increasingly becoming a subject of interest not only for scientists but also for investors in Poland [Nyka 2013, Bujniewicz 2019, Piątek 2016], studies on urban scales are still secondary topics in studies on the revitalisation of urban waterfronts [Lorens 2013] or in research on broadly understood blue-green urban infrastructure [Konopka 2002]. The results of current Polish research, mainly concerning the integration of scales and problem areas, are disseminated across international publications. These are mostly cross-sectional theoretical studies that explore a prospective form within the framework of global climate and environmental concerns [Januszkiewicz, Gołębiewski et al. 2024].

Until recently, FA was mainly perceived as a valuable form of artistic expression or alternatively as a technical experiment. From an urban planning perspective, inspiration for FA applications is derived from sources external to the exploration of European tradition. The analysis of regional construction practices, mainly on the southern Chinese coast, the archipelagos of Oceania and settlements in the floodplains of Asia's great rivers, such as the Mekong Delta on the border between Laos and Thailand, is of great is of paramount importance for the advancement of this field of study. At the heart of these settlements are structures that increase the flexibility of buildings in response to changes in water levels, which characterise the development of fishing villages. Innovations made in the era of climate change,

frequently in the *low-high-tech*[3] spectrum, are designed to address to the growing problems of those regions. At the same time, they draw the attention of European designers and planners to the potential of innovative solutions to local development challenges.

The main trend in practical applications of FA has so far been a kind of programmatic counterpoint in the context of waterfront public spaces and a pillar of luxury hotel and residential offerings. In recent years, there has been a paradigm shift in the perception of the potential of FA solutions. Once seen merely as a response to the growing housing problem, solely in regions directly exposed to the effects of climate change, FA solutions are now recognised as an important tool for planning and revitalisation, especially in metropolitan areas experiencing shortage of available building land. This trend includes specific solutions using canals and basins that are no longer used for port and shipping purposes. It is being gradually developed through the use of large-scale floating artificial islands as an alternative to building full polders, which are used to facilitate the urbanisation of shallow coastal areas. The conventional approach to shifting the coastline constantly uses technological advances to reduce the costs of expanding safe settlement in reclaimed areas and depression zones. Experiences on this scale bring us closer to the implementation phase of expansive solutions, known as *ocean habitats.* They are part of a trend initiated in the early 1960s by architects such as Kenzo Tange (Tokyo Plan 1960) and Kikutake Kiyonori (Marine City 1963). These habitats represent a response to new development challenges – building shelters for the so-called climate *refugees* migrating from areas permanently threatened by rising sea levels.

Following the experimental phase, which was mainly supported by public funds, FA was incorporated into the expanded urban planning toolkit. At the dawn of the second decade of the 21st century, technical and legal solutions improving the private sector's implementation of FA solutions became widespread**,** not only in port and coastal centres. This led to a significant evolution of trends towards the application of FA in four main areas, addressing the complex development challenges of cities and regions. These are:

1) revitalisation of an extensive network of inland waterways and post-port water bodies, especially those with an uncertain future, which for decades have been subject to restrictions on permanent development for urban purposes, due to, among other things: (a) the cost of reconstruction, (b) legal and administrative status, e.g. reserves for port and transport use,
2) economic and residential revitalisation of the coastal areas with unstable shores, typical for: (a) reservoirs created as a result of the reclamation of excavations and opencast mines, (b) areas at risk of flooding,

[3] High-low tech is an approach promoted by a research group at MIT that studies the correlations between the use of high-tech materials and technologies and solutions derived from pre-industrial building traditions (according to MIT Media Lab Overview ‹ High-Low Tech — MIT Media Lab

3) new urbanisation in shallow sea areas resulting from limited availability of building land due to ownership structure, administrative barriers and/or geo- and hydrotechnical changes,
4) conceptualisation of theoretical frameworks for the establishment of artificial ocean habitats as temporary or permanent refuge islands for climate refugees from archipelagos threatened by rising sea levels.

The following paragraphs present selected examples illustrating, often in a complex manner, the aforementioned trends. Dutch projects mainly follow the third trend, while British-London projects, similarly to the Scandinavian ones (Copenhagen and other Danish-Swedish projects), explore the first trend. German practice in Lusatia demonstrates the development of applications of the second trend, and the selection of non-European examples shows the complexity of creating large-scale floating habitats that fit into both the third and fourth trends.

The article presents the systematised results of the work of an inter-university scientific and teaching team composed of: Dr. Hab. … and Dr. … The research concerned the identification of the main trends in the application of floating architecture in the revitalisation of urban waterfront areas. The research was carried out in search of answers to two main research questions:

1) To what extent do FA solutions go beyond the architectural scale and evolve into a tool for urban planning solutions?
2) Which form of urban landscape represents the highest-rated solutions using floating architecture?
3) How does Polish practice relate to solutions employed in other countries that are regarded as prototypical or model solutions?

A preliminary review of Polish and foreign literature on the subject was conducted for research purposes. This review focused on the description of European examples of good practice. In addition, the materials from our own field studies were reviewed and supplemented. The conclusions from the introductory part were used to define the topic and scope of two master's theses on the development and activation of waterfront areas. As part of the theses, two hypothetical conceptual design studies were created, together with theoretical studies providing an in-depth analysis of the design issues:

2. TYPOLOGY OF OBJECTS AT THE WATERFRONT

An important element for studies on FA and its applications is the definition of conceptual categories and the establishment of a boundary between *floating architectural objects*[4] and units that should be defined as boats or ships (Photo 1d, Photo

[4] In English, the terms *floatig (floating on water but not drifting) and buoyant (meaning resilient, light, floating on the surface (of a liquid))* are used here*, as mentioned by [Piątek 2016].*

2a-2b, Photo 4, Photo 5b, Photo 6, Photo 7). The fundamental distinction resides primarily in the structural solutions that enable (a) independent, safe navigation using their own propulsion devices (boat) or (b) movement under tow without their own propulsion (barge). Researchers in this field systematically organise the existing architectural and structural solutions, commonly referred to as *floating architecture*, whose typology covers a wide spectrum of waterfront structures and *structures that float* independently on water. They take into account the nature of the water body, the location in relation to the water surface, shore and bottom, as well as the technology employed[5] [Piątek 2016], [Kuryłek 2019].

The difficulty in studying this subject can be attributed to a myriad of factors including linguistic and translation challenges that necessitate the consideration of local specifics and adaptation to technological advances. This is particularly evident in urban planning studies that do not deal with technical aspects as key issues. For the purposes of this article, Polish terminology has been adopted, taking into account the general division that occurs in specialist studies and is observed in professional debate. This reflects, in a generalised but methodologically correct way, the understanding of architectural and construction issues applied worldwide, sufficient for the description of applications on an urban scale.

AP facilities are typically anchored *to* platforms *that* are *buoyant* and *designed for* the purpose of *water*-based operations, rather than for the function of continuous movement and navigation. This is the primary distinguishing feature that differentiates APs from residential boats, including *houseboats*, *barge houses*, and *other similar vessels (hereinafter referred to as HBs)* whose original design was intended for safe navigation using their own propulsion or as a towed object (Photos 1a – 1b). These include both objects designed for stationary use, with the possibility of intermittent towing as well as units that have been adapted for these purposes as residential or commercial watercrafts. It is important to acknowledge the additional distinction that is made in relation to floating hotel facilities. The term "*flotels*" refers to immobile (fixed) facilities that float on water[6], whereas the term "*Botels*" refers to facilities that are designed as independent, self-propelled vessels serving as hotels. Research in the field of waterfront architecture has led to the emergence of novel technical and architectural solutions, thereby establishing new categories such as *amphibious architecture (AA)* and *boathouse architecture (BA).* These are waterfront facilities that are permanently anchored to the ground. Their distinct, adaptable configuration enables them to operate reliably in settings characterized

[5] Piątek distinguishes six different types of structures based on their construction (no Polish equivalents of the names used are provided): (1) Static elevation building, (2) Amphibious building, (3) Waterside building, (4) Pile building/stilt building, (5) Floating building, (6) Houseboat [Piątek 2016].

[6] Armchairs primarily offer inexpensive lodging for port workers, including, among others, crews servicing oil rigs. However, in the era of the expansion of the tourism industry, they are undergoing a shift in connotation by entering the market of luxury hotel services.

by fluctuating flood-induced water levels. In the event of flooding, it mitigates the risk of structural damage and functional impairments, thereby preserving architectural harmony. The AA solution employs a specialized dry dock-type foundation design that enables the building to rise safely under the pressure of flood water flowing into the dock basin (Photo 5a). *BA* solutions, on the other hand, are used for buildings suspended above the maximum expected flood water level. A characteristic feature here is the overhanging part of the building above the water level, often supported by a system of flood-resistant supports or even protruding from the water (Photo 5c), or, in newer solutions, the use of the ground floor as a boat garage directly connected to the water body (Photo 1c). The area susceptible to flooding encompasses rooms that may be periodically flooded – as the name suggests, they were traditionally used to store boats and water equipment.

A

B

C

D

Photo 1a (top left) a houseboat in Wilhelmsburg, Hamburg and 1b (top right) in *Aberdeen floating* village, Hong Kong, 1c (bottom left) *boathouse-type* residential house in Wilhelmsburg, Hamburg and 1d (bottom right) summer house in FA construction on the artificial lake Partwitzer See in Lusatia, Germany (Source: own)

3. EXAMPLES OF SOLUTIONS ILLUSTRATING THE FOUR MAIN TRENDS IN THE PRACTICAL APPLICATION OF FLOATNING ARCHITECTURE

3.1. The Dutch experience – creating landscapes in the era of climate change

Dutch specialists have been the undisputed leaders in developing technical and planning solutions that enable cities to adapt to climate change using FA and its derivatives. This status is the result of constant feedback between theory and practice in planning dedicated to creating artificial landscapes for new urban developments on reclaimed urban areas (trend three). The examples described below integrate all four main trends in the use of FA and its derivatives. They enter new water areas, but also revitalise areas of disused waterways. The process is taking place in one of the most densely populated regions of Europe – the heart of the Dutch economy, Randstad (Amsterdam-Rotterdam-The Hague). A rigorous approach to the anticipated rise in sea levels is associated with efforts to optimise climate change adaptation strategies. It is imperative to note that the threat posed by water is not limited to a single aspect. A deep understanding of its nature allows us to see it as a partner for the implementation of technical and organisational solutions open to applications in the field of FA. An example of this approach is the research conducted at *the Maritime Research Institute Netherlands* (MARIN) on a model of an energy-independent floating platform with a diameter of 5 km. It is postulated that such *floating islands* could potentially serve as an alternative to the conventional method of creating polders. This proposed solution is asserted to offer a cost-effective alternative, both in terms of construction and operation, to the prevailing approach[7] [Waals, Bunnik, Otto 2018]. MARIN's research shows that the transition from floating single objects and their complexes to extensive aquatic habitats is now a conceivable solution, similar to the Masdar City experiment – a fully independent desert district of Abu Dhabi (UAE). The highly advanced state of Dutch theoretical research is possible thanks to the gradual acquisition of practical experience. Innovation in the context of cooperation with water is developing in many ways, combining traditional experience with the latest technical solutions. Examples illustrating representative implementations of FA and its derivatives (AA, BA, etc.), analysed from an urban planning perspective, include:

l) established in Ypenburg, The Hague. Although the master plan for the polder development envisaged 7,000 homes[8], in 2005 the first experimental complex of 900 residential units in the form of so-called water villas was completed here.

[7] Date of access: 10.10.2024 https://constructionclimatechallenge.com/2017/08/09/dutch-plan-5km-wide-floating-mega-islands-for-future-living/

[8] Date of access: 10.10.2024 hwww.mvrdv.nl/projects/152/ypenburg

In its description of the concept, MVRDV writes about *the* popular *Waterwijk* in *The Hague*[9] *(...) the scale, a total of 900 homes, allowed for innovation. Is it true that 10% of the project budget can be allocated to innovation? According to the principles of economics, experimentation is possible as long as the other homes carry less risk. However, by saving costs on one island – creating fewer quays, reducing infrastructure needs and simplifying solutions – MVRDV made it possible to invest creatively in the creation of another island – creating new, experimental environments on it (...)* (own translation).

2) The unique polder part of Amsterdam known as IJmeer. Its part – Ijburg, is undergoing a gradual transformation into a prominent *water district* in Europe, *i.e.* a kind of archipelago of ten urban islands. In 2009, *the Waterbuurt West* residential development complex was built here, designed by *MR A&U* and Architectenbureau Marlies Rohmer, comprising approx. 50 floating luxury homes. It was soon complemented by a mirror-image development carried out by individual investors. The whole project fits in with the target concept of a socially and programmatically sustainable district of 45,000 inhabitants. In 2011, the authors wrote about their project: *Is it a boat? Is it a house? Is it romantic or pragmatic? It is a hybrid. It is not what you think. A complex of 75 floating houses and quayside villas under private ownership for own residential use and for rent (...) qualifies as a significant solution to the modern housing needs of the Netherlands. Canals with houses on the water, with a local restaurant or hotel, are of course a familiar sight in Dutch cities. But these are always individual solutions, more reminiscent of boats than houses. (...) Strategic spatial integration of existing cities generates a clearer contrast between urban and rural areas, making new urban developments unnecessary or even harmful. Living – and working – on the water is, in fact, a complex use of space. It is also a way of transforming obsolete port areas and flooded quarries. What is more, aesthetic considerations and the fact that it promotes a sense of freedom and closeness to nature are arguments in favour of living on the water (...)*[10].

3) The pioneering Sluishuis in Ijburg. It is a 10-storey (52 m) multifunctional building on a floating island platform, which was built in 2022. It is a terraced structure with a usable area of 46,000 m², described as *a* scenic local *landmark* of the water district. It is additionally surrounded by a cluster of 30 floating single-family homes, complementing the fully commercial development designed by a consortium of *Bjarke Ingels Group* and *Barcode Architects*.[11]

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[9] Date of access: 10.10.2024 www.mvrdv.nl/projects/153/watervillas

[10] Date of access: 10.12.2024: www.archdaily.com/120238/floating-houses-in-ijburg-architectenbureau-marlies-rohmer

[11] Date of access: 10.12.2024: www.dezeen.com/2016/11/30/big-bjarke-ingels-group-barcode-architects-terraced-block-sluishuis-ijburg-amsterdam/

3.2 The British experience – the revitalisation of London's basins and post-port canals

The tradition of living on water is still strongly cultivated throughout the United Kingdom and is a viable option in major cities for those seeking an alternative and economical lifestyle[12]. This can be described as a kind of movement towards living on the water, either permanently or temporarily, associated with the possibility of moving around the country[13]. An example of this is *Swan Island* in Twickenham, west London. This unique *floating private village* on the Thames was established 60 years ago on a private initiative. It consists of a community of about 40 households living in floating units adapted for stationary residential purposes, known as *houseboats*, numerous hybrid solutions and unique FA structures.

In the context of such cultural conditions – an ongoing tradition of living by and on the water – the adaptation of Dutch experiences in the field of modern FA solutions found particular understanding in London in the context of the growing housing crisis. In 2013, in an architectural competition announced by the *NLA New London Architecture* think tank and the Mayor of London's office, the 10 winning entries included analyses and solutions highlighting the potential of disused waterways and harbour basins. The award-winning consortium *of Baca Architects and Floating Homes*[14], specialising in the field of so-called *Aquatecture* [Barker, Coutts 2016], proposed a solution inspired by Dutch practice, i.e. the creation of 7,500 new, accessible, eco-friendly homes (prefabricated) within a month, floating along the banks of London's disused canals. In 2006, in accordance with the winning design by Baca Architects, *Floating Homes* built a prototype modular floating home in the Chichester Canal[15]. *Baca Architects* are also the designers of the first British amphibious home built on the banks of the Thames in Marlow (2016). The structure can adapt to water level changes of up to 2.5 metres[16] (Photos 2a and 2b).

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12 See also [Krenz 2018]

13 An example of this is the Scottish initiative www.livingonwater.co.uk (Date of access: 10.10.2024)

14 Date of access: 10.10.2024 www.architecture.com/find-an-architect/baca/london/chichester-floating-home-west-sussex

15 Date of access: 10.10.2024www.floatinghomes.ltd.uk/chichester-prototype.html, www.dezeen.com/2016/10/23/chichester-model-canal-baca-architects-wooden-floating-home-uk/

16 Date of access: 10.10.2024 www.dezeen.com/2016/01/20/baca-architects-bouyant-amphibious-house-river-thames-buckinghamshire-floating-architecture/

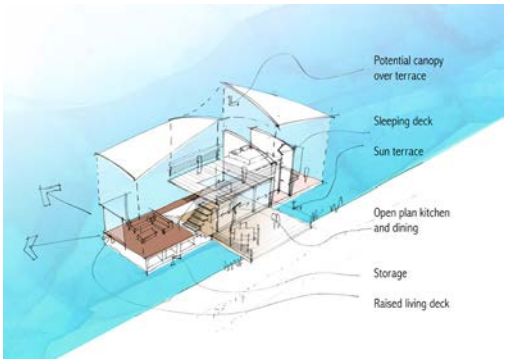
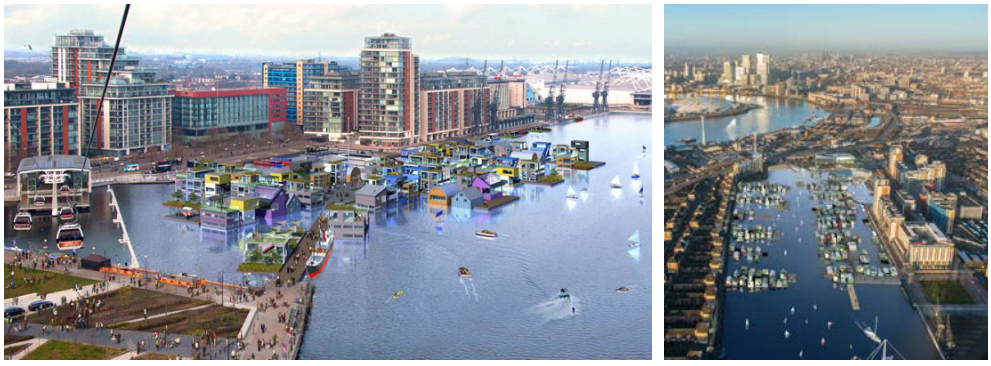


Photo 2a: (left) floating houses by Baca Architects, as a competition response to solutions for the housing crisis in London, and 2b (right) design of a modular house by Baca Architects (Source:www.architecture.com/find-an-architect/baca/london/chichester-floating-home-west-sussex, www.baca.uk.com, Date of access: 10.10.2024)

The use of FA solutions became the core of a new concept for the city's approach to the *Royal Victoria Dock* area in 2014. In the 1980s, London's *Docklands* were the undisputed cradle of transformation of post-port areas, carried out in accordance with neoliberal economics open to innovative business solutions. The *Royal Docks* area was envisaged as a place for generating economic impulses and, as such, provides an ideal environment for the market reinforcement of new trends in a global metropolis. Port functions for passenger services for cruise ships and private tourist vessels have been combined here with functions related to the nearby Canary Wharf business district. The *ExCel* exhibition and conference centre with its extensive hotel base (including the luxury *Yacht Hotels Sunborn* botel*)* is connected to a transport system that includes a local business airport, good access to the road network, the urban transport system with the *Docklands Light Rail DLR Royal Victoria* station*,* and the unique *Emirates Royal Docks* cable car*,* offering views along the Thames to *the Greenwich Peninsula*. The entire vast area has been undergoing redevelopment for decades, but has still not achieved the critical mass to outweigh the dominance of the large ExCel exhibition centre complex, which is completely closed off architecturally from interaction with the harbour basins. The noticeable lack of port activity, which intensifies the feeling of acute emptiness, is inadequate for the economic potential that are visible here. Recognition of this phenomenon has led to the development of solutions that indirectly illustrate the potential of new trends combining the contemporary technical and architectural capabilities of the Port Authority with *pop-up* market phenomena, i.e. temporary facilities for periodically operating services.

The East End *London Floating Village* urban architecture competition resulted in the selection of a preliminary master plan concept for a six-hectare floating structure. It was developed by a design and development consortium, in which the British winning competition team, *dRMM Architects (*Photos 3a and 3b) and

Igloo Regeneration joined forces with Dutch partners Monteflore, Floatbase and Marlies Rohmer Architects & Urbanists, who have experience in projects such as *Waterbuurt West* in Amsterdam's Ijburg. The water village programme aims to create an active neighbourhood community (50 residential units), bringing together creative people from different social backgrounds in a waterside lifestyle. Referring to the characteristics of the surroundings, FA concept also includes an extensive service and recreation programme (with a swimming pool and ice rink) comprising a total of approx. 200 different types of floating units (12,000 m^2 of usable space). Political changes in the London authorities led to the project being halted in 2016. The decisive arguments were the issue of airport nuisance and safety zones and the social dimension of the local economy, which the new Mayor of London, Sadiq Khan, treated as a priority.



Photos 3a and 3b: Victoria Royal Dock as East London Floating Village according to the competition concept by *dRMM Architects* (Source: https://inhabitat.com/englands-first-floating-village-coming-soon-to-east-londons-royal-docks/, date of access: 10.10.2024)

3.3. The Scandinavian experience

3.3.1. Copenhagen's plans for hybrid waterfront districts

Copenhagen is considered the third strong centre recognising the potential of FA, which, like Amsterdam and London, faces the problem of affordable housing. Copenhagen's Nordhavnen is the Danish response to Dutch solutions in the pursuit of artificially expanding the range of investment areas, a process which is taking place under the pressure of from market mechanisms regulating prices and the availability of land on the mainland. A new 200-hectare *residential and commercial* district is being constructed on an artificially reclaimed former port area. It is currently the largest inner-city development area in Scandinavia. Over the next few decades, a settlement for 40,000 residents is to be built there. The implementation plan is currently being developed by a consortium of COBE Architects and SLETH

MODERNISM, Polyform and Rambøll[17]. The creation of a high-quality living environment involves recreational infrastructure challenges – safe, universal access to water. Located in the central part of the district, near the international school, *CF Møller's Nordhavn Islands* project introduces a complex of floating swimming pools[18] to the public space. This is a growing trend in revitalised post-port water areas, known from the centres of Copenhagen (Islands Brygge), Berlin (*Badeschiff* in Kreuzberg) and Antwerp (*Badboot).*

3.3.2. *Urban Rigger* – a Scandinavian floating housing module

Openness to alternative solutions for water relations, allowing for the use of both FA and derivative structures resistant to changes in water levels, was combined in Copenhagen with a priority issue in the Danish system – the social dimension of waterfront development. The issue of affordable housing, including the needs of the large academic community, was addressed in the *Urban Rigger* project by the BIG Bjarke Ingels Groupe design office (photo 4). This project may be regarded as a flagship project among the numerous experiments currently underway in FA design. In response to the projected 4 million student housing deficit that is expected to affect European cities after 2025, BIG proposed a floating complex of six modular student micro-housing units in the Refshaleøen post-port district of Copenhagen. It has become a tool for revitalising disused quays and water areas, and has made it possible to keep students in the deserted city centre of the metropolis. Due to the implementation of a recycling strategy, the cost of the solution was reduced and the unique port character of the complex was maintained – nine shipping containers connected into a floating module offer 12 studio flats. The regular shape of the plan allows the modules to be combined into larger floating structures. The *Urban Rigger* model has been used in a number of European cities. In Nordre Frihamnsbassängen (Gothenburg, Sweden), there are plans to build a student village with 216 affordable accommodation units in 12 modules, in accordance with the plans of architects from BIG[19]. It has been asserted that this technology makes it possible to create 200 to 300 floating modules per year, which translates into 2,000 to 3,000 available student residences (according to Loudrup for EUobserver). *Urban Rigger* proves that, thanks to its simple design, the solution can be multiplied and adapted in conditions far from Scandinavian standards. At the same time, it is a strong reference to the historical origins of FA solutions – the adaptation and reuse of containers (*reuse*, recycle) so evident in the idea of living on old boats and barges (*houseboats)* withdrawn from regular service or in boathouses converted into flats[20].

[17] https://ramboll.com, Date of access: 10.10.2024
[18] https://aasarchitecture.com, Date of access: 10.10.2024
[19] https://www.urbanrigger.com/projects-gothenburg/ https://euobserver.com/regions/135030, Date of access: 10.10.2024
[20] https://www.urbanrigger.com/, Date of access: 10.10.2024

Photo 4. *Urban Rigger* by the BIG Bjarke Ingels Groupe design office (own source)

3.4. The German experience – FA for landscape restoration

Germany has extensive experience in implementing large-scale revitalisation programmes in the format of IBA Internationale Bau Austellung. This is an organisational structure focused on the implementation of solutions dedicated to the development of an area undergoing special, multi-faceted restructuring. Innovation is understood here holistically – technical challenges are addressed by the implementation of innovative administrative solutions, for which appropriately designed financial and legal tools are created. The pioneer in introducing FA into systemic spatial solutions was IBA SEE, or Internationale Bau Austellung Fürst-Pückler-Land, operating in Lusatia between 2000 and 2010. IBA SEE, or IBA *Jeziorna*, dealt with the issue of restoring the economic independence of the new lake district[21], which was being created on the systematically

[21] http://wirtschaftsregion-lausitz.de/, Date of access: 10.10.2024

flooded post-mining brown coal excavations of the Neisse River. IBA SEE focused more strongly than previous processes of this format (IBA Ruhr Gebiet) on the nature of the change process. Strong emphasis was placed on the potential of transitional programmes and solutions, adapted to the current phase of the decades-long process of landscape restoration and strengthening of the local community in the *shrunken*[22] region [Rembarz 2018]. One of the tools of this approach was the promotion of alternative tourism. An important pillar of this approach was the FA (German: *schwimmende Hauser*) solution, which facilitated the activation of reservoirs whose banks have been undergoing geotechnical stabilisation and re-naturalisation processes for several decades, and the waters of which are gradually changing their chemical composition, adjusting their pH to the standard required for normal use for sports and bathing[23]. The long-term objective of the IBA activities was to change the image of the region and reverse negative migration trends. An attempt was thus made to apply Amsterdam's solutions in Lusatia, adapted to local hydrological and legal-administrative conditions, which were developed on the basis of analyses carried out as part of international research projects [Rembarz 2018].

The adoption of the IBA format for the transformation of the Wilhelmsburg-Harburg area – Hamburg's port districts – was aimed at overcoming the unfavourable image of so-called *metro zones.* This is a category defining inner-peripheral areas where the activation of endogenous development potential requires the implementation of innovative strategies [Rembarz 2018]. In recent decades, the area at the fork of the Elbe delta has experienced repeated flooding and has become an area where the problems of a multicultural immigrant community have accumulated. The city's new policy, called *Leap across the Elbe*, was intended to develop innovative principles for land development and management. One of the three main problem areas of the ten-year transformation was the issue of increased flood risk associated with rising sea levels. In contrast to London, Hamburg is still an open port, so a key issue in the development of the city's waterfronts is to take into account not only the daily tides, but also the frequent flood waves carried by the river current, which are now often exacerbated by torrential rains. In its pursuit for solutions that are both sustainable and cost-effective, IBA Hamburg investigated the feasibility of using FA and its derivative structures as an alternative to the construction of elevated embarkments (see photo 5). A number of model technologies for flood-resistant foundations are demonstrated by the *WaterHouses* programme in the *Wilhelmsburg Island Park* area, which uses amphibious structures. However, the key to promoting FA in Hamburg is the implementation of the fully energy-independent floating

[22] This refers to the so-called shrinking processes, i.e. socio-economic de-development characterising the industrialised regions of the former GDR at the turn of the 20th and 21st centuries (German: *Schrumpfende Region*, English: *shrinking region*), such as the lignite mining area in Lusatia (Cottbus), industrialised areas in Saxony-Anhalt such as Wolfen-Bitterfeld-Halle and Leipzig, an icon of the fight against shrinkage and urban decay [Rembarz

[23] For more information, see www.lausitz-resort.de Date of access: 10.10.2024

office building *IBA Dock*[24]. Its operation in the basin of the former *Müggenburger Zollhafen* customs terminal demonstrates contemporary technical possibilities for revitalising basins and post-port canals in a sustainable manner, while at the same time not compromising the continuity of elevated flood defences [Hamm, Bartels 2010]. Situated on the opposite side of the basin is *the Mügge* community centre. It uses *boathouse architecture,* which is also promoted in the *Harburger Binnenhafen* area – the former river port of Harburg. *Marina Schlossinsel* is a luxury residential complex located on the edge of the former port canals. Each building has garage spaces for boats on the ground floor, opening directly onto the harbour basin, from which, thanks to the canal network, the centre of Hamburg can be reached more efficiently by motorboat than by land [Rembarz 2018b].

Photo 5. Architectural proposals for the use of structures resistant to high flood waves implemented as part of IBA Hamburg: (from left at the top) (5a) amphibious buildings from the *WaterHouses* programme*, (5b)* the *IBA Dock* office building, and (5c) the *die Mügge* community centre (Source: own)

Research in the field of urban studies has made it apparent that there is a salient relationship between public administration and private sector activities across various European countries. Hamburg is described as an important centre for the development of floating housing trends, although this is a relatively new phenomenon in this metropolis. However, it should not be forgotten that the traditional connection with water has not been broken in this part of Germany and the idea of owning a boat is not a foreign concept here, as it is in Scandinavia, the Netherlands or the British Isles. Based on a framework plan developed in 2016, the city council is

[24] www.detail.de/artikel/die-architektur-lernt-schwimmen-1481/, https://www.archdaily.com/288198/iba-dock-architech https://www.internationale-bauausstellung-hamburg.de/en/projects/iba-dock/projekt/iba-dock.html, www.internationale-bauausstellung-hamburg.de/en/projects/the-building-exhibition-within-the-building-exhibition/waterhouses/projekt/waterhouses-living-at-inselpark.html, Date of access: 10.10.2024

endorsing the developing model of aquatic living in the form of houseboats and new housing solutions in the FA model. At the same time, it revitalising canals that have been excluded from port functions in planned locations. In this way, Hammerbrook, an office and manufacturing district suffering from a lack of urban life and dominated by a vast railway and transport hub, is changing its austere profile (photo 6).

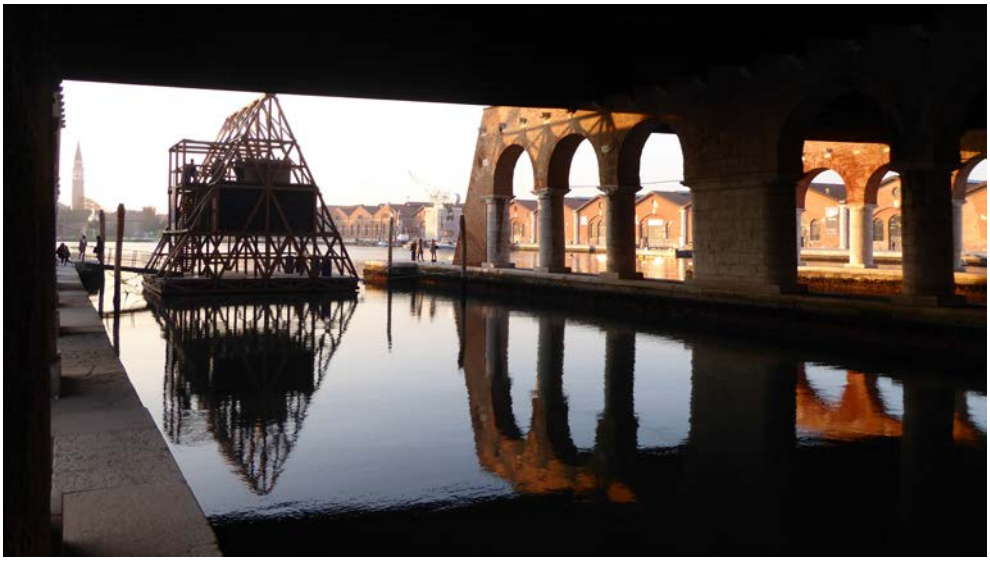


Photo 6. FA in Mittelkanal Hamburg-Hammerbrook (Source: own)

4. NATURAL DISASTERS, FORECASTS FOR THE FUTUTRE AND FA

Collective experiences of crises, particularly natural disasters, have become a catalyst for a wide range of changes in both thinking and action. A landmark experience for the United States in the past decade was the reconstruction of New Orleans, destroyed by Hurricane Katrina in 2005, which was hampered by the global financial crisis of 2007-2009. The destruction of the American South (mainly the states of Louisiana, Mississippi and Florida) necessitated the introduction of numerous modern solutions to increase *the resilience* of metropolitan areas. This mainly concerned public structures and facilities, especially technical infrastructure such as bridges, embankments and flood defences, as well as transmission lines. In collaboration with experts from Amsterdam, a new flood protection strategy for the city was developed, and New Orleans began to introduce new FA solutions[25]. However, the process

[25] www.globalconstructionreview.com/trends/dutch-experts-assist-new-orleans-new-water-plan/, Date of access: 10.10.2024

of restoring the city to life became an area for competing interests. The potential for technical and organisational modernisation using FA, AA and BA structures has clashed with existing market habits reflecting the dominant trends in customer lifestyles. The differences in scale and thinking models were particularly evident in the debate in which Amsterdam's solutions were compared with the neoliberal American city. This was particularly evident in the issue of affordable housing[26]. The main consequence of the hurricane-induced flooding was a profound housing crisis among the poor communities of New Orleans. Given the extent of damage and growing needs, private initiatives were activated in accordance with the American model of society. One of the most notable in terms of the scope of the proposed architectural innovation was the *Make it Right Foundation*, sponsored by the American film star Brad Pitt. In pursuit of the goal of environmentally friendly reconstruction of the city, the Foundation carried out the reconstruction of a socially sensitive neighbourhood as a model project. The *New Orleans Lower 9th Ward* project involved world-renowned architectural firms such as Pugh & Scarpa, Adjaye Architects, MVRDV, Kieran Timberlake and Morphosis Architects. They created 21 prototypes of flood-resistant housing complexes, each involving the construction of 150 affordable eco-friendly homes. In this unique urban laboratory, testing complex technical and organisational conditions, the proposal by the American firm Morphosis Architects gained particular publicity. Unfortunately, due to non-technical reconstruction conditions, their prefabricated amphibious FLOAT House did not become a new, widespread modular solution. This example contributes to studies on the role of tools for dissemination of technical innovation in neoliberal urban management systems.

Material for similar observations is also provided by the analysis of the reconstruction of regions destroyed by tsunamis and/or earthquakes, such as Thailand in 2004 or Haiti in 2010. There, too, the potential and need for advancement in the dissemination of new ecological and technical awareness, taking into account the challenges of adaptation to climate change, is recognised. However, the passage of time has demonstrated that despite the conceptualisation of solutions at the level of *floating habitat* visions, such as *Harvest City* for Haiti by Boston-based E. K. Schopfer, reality still does not support even their partial implementation. Disasters engage politicians and spark the imagination of designers. They also open up intellectual space and funding for complex research for the benefit of *coastal communities* located in areas of immediate danger. Concepts similar to the vision *of Currents for currents* by the *Dada* architectural office in Manila, Philippines (Photo 9a) can serve as a working research hypothesis. This proposal not only involves the spatial organisation of *a* self-sufficient coastal *water community*, but also combines its economic functioning with the production of electricity using ocean waves and natural constant water currents.

[26] A popularised description of the situation in Polish is provided by Dan Baum's 2017 book entitled Dziewięć Twarzy Nowego Orleanu (Nine Faces of New Orleans) (published by Czarne)

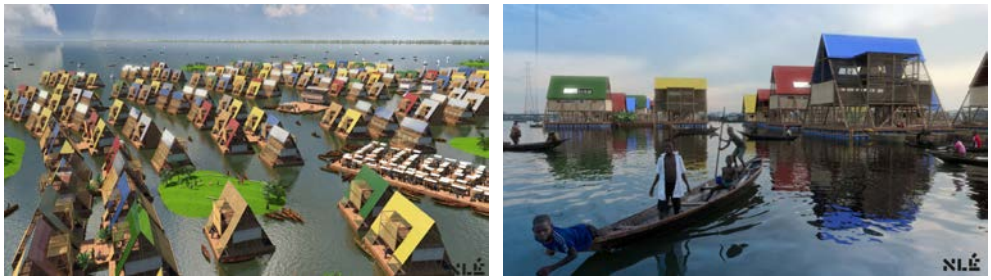


Photo 7 *Makoko Floating School* from the Oko-Agbon district of Lagos, Nigeria, designed by NLÉ/Amsterdam_Lagos in 2013, was symbolically displayed in a scaled-down model at the international architecture exhibition – La Biennale di Venezia 2016 entitled: *Reporting from the Front*. (Source: own)

Photo 8. The prototype of the floating house design by NLE was used in the model strategy for the renovation of „water slums" according to the Lagos Water Communities Project 2013 document, developed by NLE (Source: NLE)

Based on similar premises, a concept was devised by the Dutch-Nigerian architectural firm NLE, focusing on technical solutions that could be quickly implemented for the 10,000-strong *Oko-Agbon* district and *the Makoko Community*, inhabiting *the* Nigerian *floating slums* in the megacity of Lagos. The future of this symptomatic place on earth became the subject of discussion at La Biennale di Venezia in 2016, entitled *Rapporting from the Front*, as part of a special project entitled *Rapporting from Cities: Conflicts of an Urban Age* prepared by London School of Economics Cities (LSE Cities) in consultation with UN Habitat III. The model strategy for the renewal of Lagos' *water slums*, according to the *Lagos Water Communities Project 2013* document (photo 8), contributes to the discussion on the needs and possibilities of solutions for the adaptation of cities in the global south to climate change. The NLE approach (photo 7), combining high-tech solutions with low-tech possibilities (*high-low-tech solutions*), was a significant counterpoint to the visions created for cities by technically and economically advanced countries such as China, which are unattainable for developing countries. An example of this is the *Floating City* concept for the Hong Kong-Zhuhai-Macao Bay Area, prepared by AT Design Office[27]. This fully modern vision makes no reference to the local tradition of water-based fishing settlements, exemplified by the 400 km lagoon of fishing villages. It is an agro-urban development in the Xiapu area, characterising the coastline of Ningde City in Fujian Province in south-eastern China[28].

The renowned Danish design firm BIG Bjarke Ingels Group, in collaboration with the MIT Centre for Ocean Engineering and the Explorers Club, has developed its own concept *for Oceanix City.* It was presented to the new UN *Sustainable Floating Cities* Commission in 2019 and at the World Urban Forum convened by UN-Habitat in 2020. *Oceanix City* builds on the practical experience gained in the *Urban Rigger* container dormitory project tested in Copenhagen and Gothenburg, adapting it to the global development challenges set out in the 17 Sustainable Development Goals 2030. *Oceanix City* is a network of floating, hexagonal artificial islands (Photo 9b). These modules can be combined and integrated into fractal-shaped systems, enabling the creation of urban blocks, housing estates or even entire towns, ranging from small neighbourhoods for 300 residents to towns of 10,000 inhabitants, referred to by BIG as *nautical communities. The floating habitats* will be a fully independent and self-sufficient ecosystem, thanks to the use of circular water and sewage management solutions, vertical farming and aquaponics, and energy supply from renewable sources. In a situation of limited resources, the principle of transport based on the power of nature and human muscles (sail, rowing boat, bicycle) is to be used[29].

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27 www.atdesignoffice.com/floating-city/, date of access:10.10.2024

28 https://www.dailymail.co.uk/news/article-2451023/Chinas-Tanka-boat-peoples-floating-homes.html, date of access: 10.10.2024, https://www.chinadaily.com.cn/travel/2017-10/19/content_33441456.htm, date of access: 10.10.2024

29 https://big.dk/#search, date of access: 10.10.2024

SUMMARY

Floating architecture (FA) solutions are structures that combine durability with openness to change. The fundamental notion of this approach is to maintain a constant relationship with the landscape, to establish a relationship with water, and more broadly with nature, into the daily rhythm of life. This principle guides artistic projects and is eagerly adopted in the promotion of facilities with a wide range of cultural and entertainment programmes. Perceived as an integral part of the urban landscape, FA becomes, in special situations, the very material/building block of its creation, especially in floating residential complexes and multi-scale aquatic habitats.

The appeal of such solutions resonates with the investors, thereby endowing FA implementations with market reality. FA facilities not only respond to the demand for new means of individualising tourist offers, but also expand the housing offer. Not only in terms of different economic standards, but above all in terms of lifestyle options, they are increasingly turning to *live-work* models. APs in specific conditions have greater potential for service and production projects. In business schemes, they often appear in *pop-up* projects, used both in social economy projects and in *prime* activities, e.g. in the creative industry.

Included in integrated spatial plans, FA can be a powerful catalyst for both the natural landscapes of rural areas and reclaimed post-industrial and post-mining zones. It also works well in highly urbanised centres implementing revitalisation programmes in post-port areas. However, in the absence of legal and administrative regulations that take into account spatial values and environmental issues, FA and its derivatives can pose a threat to the environment and the natural landscape. This issue can lead not only to a decline in the quality of life, a weakening of the local economy due to the attractiveness of the urban landscape, but also damage to the image of the area.

In this context, the utilisation of FA for the development of floating options for affordable housing is emerging as a new area of concern. In dynamically developing metropolises driven by neoliberal economic mechanisms and lacking effective social and housing policies, the disparity between the availability of building land (in terms of quantity and price) and the demand for living space is increasing. In non-European areas, especially those constantly threatened by the effects of climate change, this often means spatial restrictions on the full realisation of life activities. In this context, *FA* solutions and their derivatives are seen as key development policy tools, not just alternatives to the creation of safe housing and social infrastructure.

As a result, the previously strictly luxurious connotation of *floating architecture* is changing, which implies the expansion of the commercialisation process of FA as a market product. From this standpoint, the notion of floating houses, complexes, or even entire cities as ocean habitats transitions from an intellectual hypothesis to a tangible alternative. This is particularly salient in regions where frequent

natural disasters have called into question the efficacy of conventional technical solutions and urban planning principles.

A comprehensive analysis of architectural projects in the field of FA, which is part of a broader discipline *of aquatic architecture* and *water urbanism*, shows that this is not the exclusive domain of Dutch architects. However, they are experts at building a coherent planning and administrative system, thanks to which private investments by various entities are an integral part of a functioning mechanism that incorporates the element of water into shaping a high quality of life. The key to coordinating individual and public efforts is a flexibly constructed master plan, which provides a platform for cooperation between parties to create the best target solutions. The inevitability of confronting the issue is contained in a quote from a speech by BIG Bjarke Ingels Group at the UN in 2019 *(...) 9 out of 10 of the world's largest cities will experience the effects of rising ocean levels by 2050. Fate is leading us towards the sea, which may be our future. (...)*

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ARCHITEKTURA PLYWAJĄCA JAKO URBANISTYCZNE NARZĘDZIE ROZWOJU I AKTYWIZACJI STREF NAWODNYCH

Streszczenie

W artykule podniesiono kwestie wykorzystania architektury pływającej (AP) jako narzędzia urbanistyki współczesnej, ze szczególnym uwzględnieniem zagadnień mieszkaniowych. Analiza przykładów zagranicznych wskazuje na szerokie spektrum potencjału obiektów „unoszących się na wodzie". Zakończenie fazy teoretyczno-technicznego eksperymentu, umożliwia u progu trzeciej dekady XXI wieku popularyzację tego typu rozwiązań, nie tylko jako odpowiedzi na elitarne potrzeby wyrafinowanej architektury użyteczności publicznej. Obok wyjątkowych realizacji komercyjnych projektów hotelowych

na znaczących wizerunkowo frontach wodnych, powstają dziś coraz bardziej egalitarne projekty mieszkaniowe. Obiekty AP wraz z formami pochodnymi jak amphibious architecture i boathouse architecture, są już obecnie częścią stałego narzędziownika planowania przestrzennego na terenach, które z przyczyn złożonych (techniczno-administracyjno-ekonomicznych) nie mogą być zabudowane w konwencjonalny sposób. W dobie debaty wokół przystosowania miast do skutków zmian klimatycznych, architektura pływająca jest poważnie rozważanym rozwiązaniem w elastycznie odpornej (resilience) strategii rozwoju obszarów stref zagrożenia powodziowego lub wręcz sztucznych oceanicznych habitatów projektowanych dla klimatycznych migrantów. W artykule przedstawiono usystematyzowane wyniki pracy międzyuczelnianego zespołu naukowo-dydaktycznego, dotyczącego określenia głównych tendencji w zastosowaniach architektury pływającej w procesach rewitalizacji miejskich stref nadwodnych. Wyniki wykorzystano w określeniu zakresu dwóch projektowych prac magisterskich dedykowanych frontowi wodnemu Gdańska.

Słowa kluczowe: architektura pływająca, rewitalizacja miasta, transformacja frontu wodnego, wodna urbanistyka, aktywizacja nieczynnych akwenów i dróg wodnych, mieszkalnictwo na wodzie, urbanistyka współczesna, miasta portowe, mieszkalnictwo społeczne, urbanistyka w dobie zmian klimatycznych.