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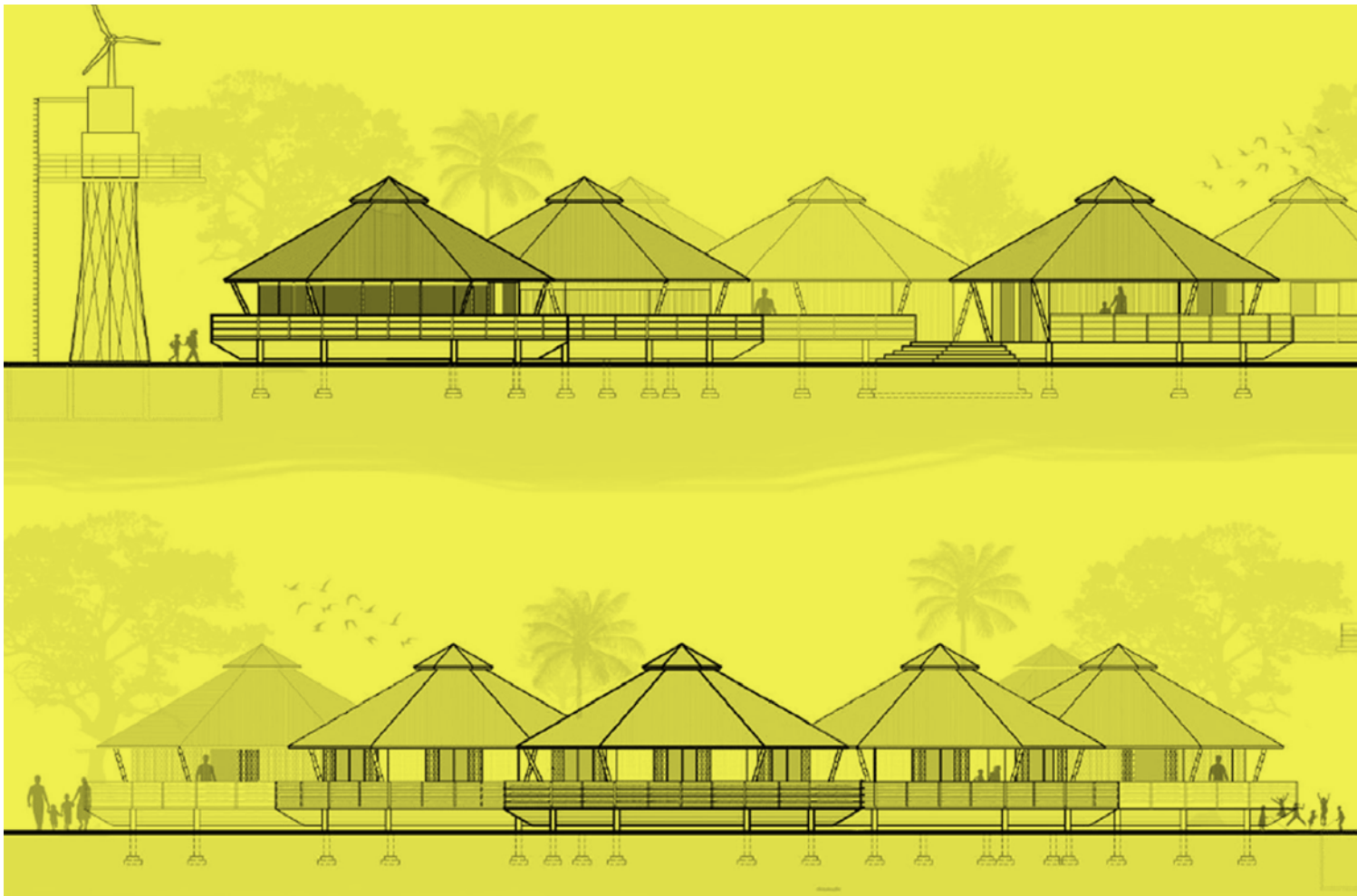
Into Action 10

2019 RISK Award

Coastal Resilience Bangladesh

Edited by Christian Barthelt and Renate Bleich



Munich Re Foundation
From Knowledge to Action

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“We plan much more than just a regular floating house!”

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Coastal disaster risk management in the face of climate-induced environmental change, population growth and urban development

Adaptation to climate change is becoming more and more important. Island states and coastal areas in many parts of the world are the regions at greatest risk since they are exposed to a number of different hazards. Today, around 40% of the world's population live in coastal areas (defined as zones within 100 kilometres of the geographical coastline). And the number of exposed people is growing rapidly. To protect these people, the following questions must be asked: What are the most useful approaches to build coastal resilience? Which innovative ideas can help reduce risks? The combination of rising sea levels, increasing weather extremes, population growth and ecological degradation will inevitably increase risk for ecosystems, lives and livelihoods.

States, communities and the people at risk must act promptly to align environmentally and human-induced developments with sustainability goals so as to keep risks within reasonable and manageable limits. Besides the stressors mentioned above, there are other challenges such as erosion, degradation of coral reefs and beaches, and soil salinization. We even witness the removal of reefs and beaches for the mining of construction materials, or to create space for infrastructure, such as piers, harbours and settlements. The 2019 RISK Award searched for projects dedicated to improving risk reduction, risk management or adaptive capacities in connection with the special situation in coastal areas.

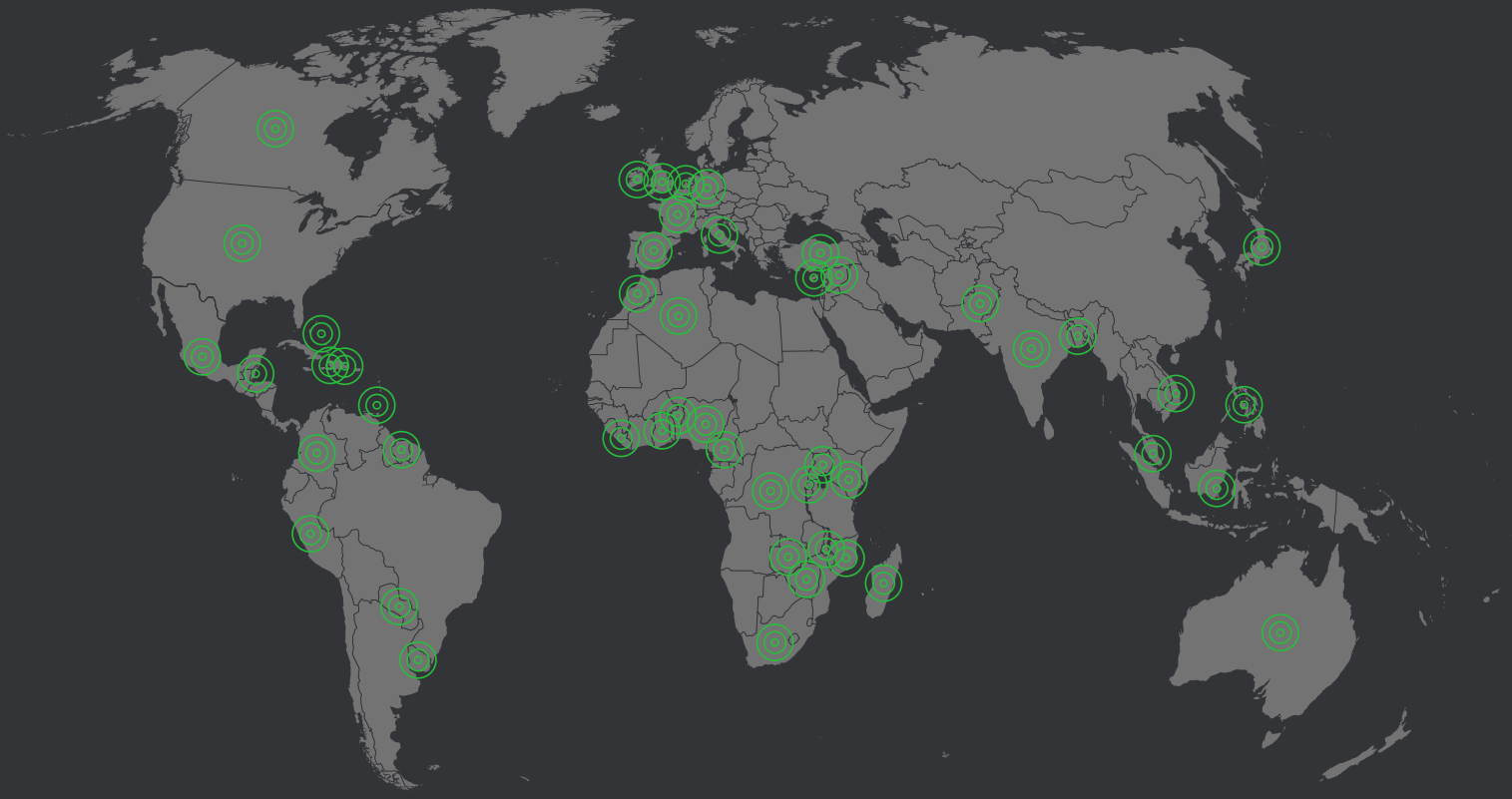
The project ideas that reached us related to ecosystem services and infrastructure approaches, capacity building or awareness raising measures, sustainable and risk-sensitive land use planning, adequate building codes and many more topics. The alignment of the projects with the Sendai Framework for Disaster Risk Reduction was of high importance. In this IntoAction, we introduce the winning project, "Disaster-resilient floating homes", from Bangladesh and provide an overview of the results achieved.

We wish you a pleasant read,

Christian Barthelt
Senior Project Manager
Munich Re Foundation

The call for proposals ended on 30 November 2018. The RISK Award consortium received 109 applications from 48 countries addressing the issue from different perspectives. The high number of proposals from around the world clearly shows the necessity for countries and people living in coastal areas to act now in order to adapt to, and cope with, climate and environmental changes.

The map shows the 48 countries from which we received applications during the 2019 RISK Award process.



The RISK Award was presented at the Global Platform for DRR, organised by our project partner UNDRR, during the official closing ceremony on 17 May 2019. Some 200 country representatives, NGO participants and media representatives attended the ceremony.

Nandan Mukherjee, Floating Homes Project Lead, representing the winning team from the University of Dundee and Resilience Solution from Bangladesh, received the trophy from Mami Mizutori, Special Representative of the UNDRR, and Thomas Loster, former Chairman of the Munich Re Foundation.

Natural hazards are part of everyday life in Bangladesh. This woman tries to save her belongings from the floods.

Disaster-resilient Floating Homes for Bangladesh

Current approaches to managing coastal disasters often focus on building large-scale engineered constructions. Examples include flood walls, embankments or cyclone shelters on raised platforms. While these initiatives can save lives, they rarely address the underlying causes of vulnerability. The 2019 RISK Award shifts that focus to a solution that is more integrated and systemic, and that helps families to address multiple challenges at once.

30%

of the area of Bangladesh is threatened by climate change effects

378

reported disasters from 1980 to 2019

On the right:
A village on Kutubdia Island, Bangladesh. The houses here are often built of mud-reinforced bamboo and reeds. The traditional architecture offers little protection against floods, storms or heat.

The project had been planned to run for 12 months, starting in July 2019. Due to the Corona pandemic, however, several workstreams were delayed. The goals of the RISK Award project were eventually achieved by July 2021.

Background

Roughly one third of the land mass of Bangladesh – home to 45 million inhabitants – is exposed to sea level rise, cyclonic storm surges, excessive soil and water salinity, tidal flooding, and coastal erosion. Extreme cyclones frequently destroy homes and livelihood assets, bringing further complex social and economic challenges. This is partly due to climatic causes and partly directly man-made, for example because of poor water management, deforestation and population growth. In order to keep coastal areas habitable for as long as possible, alternative housing concepts must be developed. To address this situation, the University of Dundee and Resilience Solution aimed to develop a concept for disaster-resilient floating homes.

These homes are not standard houseboats, but complex constructions that can float in inundated areas and are resilient to floods, storms, earthquakes and river bank erosion. Furthermore, they also tackle the root causes of vulnerability by giving families the opportunity to address multiple interconnected challenges at once. They improve livelihood standards as they include permaculture-based food production systems with small-scale chicken and fish farming options, as well as vertical garden systems attached to walls. Drinking water supplies are secured with large tanks that harvest rain water. Renewable energy systems allow families to continue conducting the most basic activities that require electricity in times of disaster and a sanitation system maintains hygiene standards. This innovative concept therefore helps families to live through periods of inundation without losing the means to satisfy their most pressing needs. The houses help them to adapt to climate and environmental changes and contribute to mitigating climate change through renewable energy production.

The project at a glance

The main project aim was to develop an innovative holistic concept to massively upscale the implementation of disaster-resilient floating homes in coastal regions of Bangladesh. The project builds on recent work funded by the Global Resilience Partnership (GRP) in which prototypes of disaster-resilient floating homes had been developed. These homes have the potential to contribute to 13 of the 17 UN Sustainable Development Goals and have attracted widespread attention from the Bangladeshi media. The work during the phase funded by the RISK Award aimed to improve structural designs and develop toolkits for the co-construction of homes that empower the most disadvantaged families. It was also to develop appropriate business models to increase the scale of the project.

The concept was developed in a participatory process in consultation with scientific experts, beneficiaries, implementers and other consultants. Well over 1,000 households were surveyed and included in a feasibility study. Around 500 local residents in Kutubdia participated in co-design meetings. More than 50 experts contributed their experience to the concept, and 20 young professionals were trained.

Furthermore, appropriate public-private partnerships and high quality outputs have been developed. The not-for-profit project created free and accessible blueprints, so that other initiatives can benefit from the work. The holistic concept now serves as the basis for an application to the UN Adaptation Fund. The potential funding from the Adaptation Fund is roughly 30 times higher than the RISK Award. Hence, the award endowment mainly served as an enabler and lever for the further scaling of the project.

1,322

households took part in the co-design process via a survey

500

local beneficiaries were included in 55 focused group discussions

Implementing organisations

University of Dundee
The University of Dundee is one of the UK's leading universities and is internationally recognised for its expertise across a range of disciplines including science, medicine and engineering. The university is also home to one of the UK's top art schools, Duncan of Jordanstone College of Art & Design, which has established an international reputation for excellence in the fields of fine art, design, television and imaging and architecture.

Resilience Solution Bangladesh
Resilience Solution is a new-generation non-profit research institution based in Bangladesh founded by climate change and environmental experts. Their core expertise is co-designing innovative nature-based solutions for communities at risk of climate change and environmental degradation. Their primary mission is to demonstrate examples to bridge the gap between academia and development practice to promote sustainable livelihood and social welfare. They provide community-driven, robust, co-designed, intelligent and innovative solutions for climate change adaptation and disaster risk reduction.

In dialogue with Nandan and Roufa

Nandan Mukherjee supervised the RISK Award project on behalf of the University of Dundee. He developed the project plans, brought the experts together and set up the team. In Bangladesh, Roufa Khanum from Resilience Solution was responsible for the implementation of the on-site measures. Both have experienced two years of ups and downs, almost all of which were overshadowed by the COVID-19 crisis. Looking back at the project, they answer our questions in a short interview.

Dear Roufa, dear Nandan, you have now worked for two years on the "Floating Homes" project with support from the RISK Award. Which result stands out the most?
The project's most significant accomplishment was designing a climate-resilient school using co-design principles for biomimicry nature-based solutions with full community participation.

Which difficulties were the most challenging?
The Covid pandemic presented the greatest obstacle to research advancement. The community was involved in every design aspect, but the pandemic restricted participation in the implementation phase.

The project "Massive upscaling of the floating home concept" is ambitious and long-term. How do you assess the progress made over the last two years?
We modified the design over the last two years based on those findings after co-designing and conducting market research in Kutubdia and attempting to demonstrate a model home. Our strategy was to instil evidence-based confidence in people that nature-based solutions are economically viable, aesthetically pleasing, and far outperform conventional solutions in terms of disaster resilience. This demonstration will inspire governments and development partners to scale up massively.

What role has the RISK Award played in achieving the goals?
The Munich Re Foundation has fully supported the project's main goal, which is to experiment with the feasibility of utilizing nature-based solutions through action research. Using co-design on a massive community scale as the design principle, the patience and support from the Munich Re Foundation during the difficult times of repeated planning and refinement is unrivalled. They should take primary credit for completing this project.

Funding or finance are often mentioned as a particular hurdle in scaling projects. How are you tackling this issue?
After finishing the designs from the Risk Award Fund, we attempted to build a demonstration with Scottish Government funding from the University of Dundee. We intend to access global climate finance based on this proof of concept.

What will the project look like five years from today?
The following will be major tasks over the next five years:
— Accessing global climate finance to build more infrastructure using the same design approach.
— To mainstream nature-based solutions in the relevant policy and strategy.
— To popularise nature-based solutions at the national and global levels through project beneficiaries, larger communities, and social movements.

Thank you very much for the interview.

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Lessons learned from the pilot project and new goals for sustainable success

The picture shows the flood-resilient home in Dularchar. The construction was a success, but integration in the societal context failed.

Before the RISK Award funding started, there was already a "Floating Homes" pilot project, funded by the Global Resilience Partnership. In this pilot project, a prototype of a floating home was developed. Two units of the house were built south of Dhaka in Dularchar on the River Ganges in 2018. Hopes for success were high, as were the expectations of the community members. During the construction phase, the project also received supra-local attention and was able to generate some employment in Dularchar in the form of shops, kiosks and more.

However, once the houses were completed, interest ebbed away relatively quickly. Some of the jobs created could not be maintained. The allocation of the houses to selected families was also not without problems and caused envy and resentment in some places. A tense political situation added to the problems, with the result that, even though the houses were technically sound and considerably reduced the risk from natural hazards, social acceptance in the community was not high enough to ensure the long-term success of the project.

For this reason, it was decided that the follow-up project, funded by the RISK Award, would be set up in a slightly different way. The lessons learned from the pilot project were an integral part of the strategic planning of the follow-up project. Participation of all stakeholders at all levels was intended to ensure that the supremely important factor of social acceptance would also be fully met. Therefore, six core objectives were defined for the project to ensure its sustainable success and scaling.

The 6 main areas of work that were addressed during the RISK Award funding period (2019–2021)

Goal

Develop designs for projects to scale up disaster resilient floating homes on coastal Bangladesh

1. Improve architectural designs for coastal regions
2. Design processes to empower disadvantaged families
3. Develop frameworks for transformational change
4. Develop business models to support scaling
5. Develop public-private partnerships for scaling
6. Produce free, widely disseminated materials

Site selection and vulnerability assessment survey

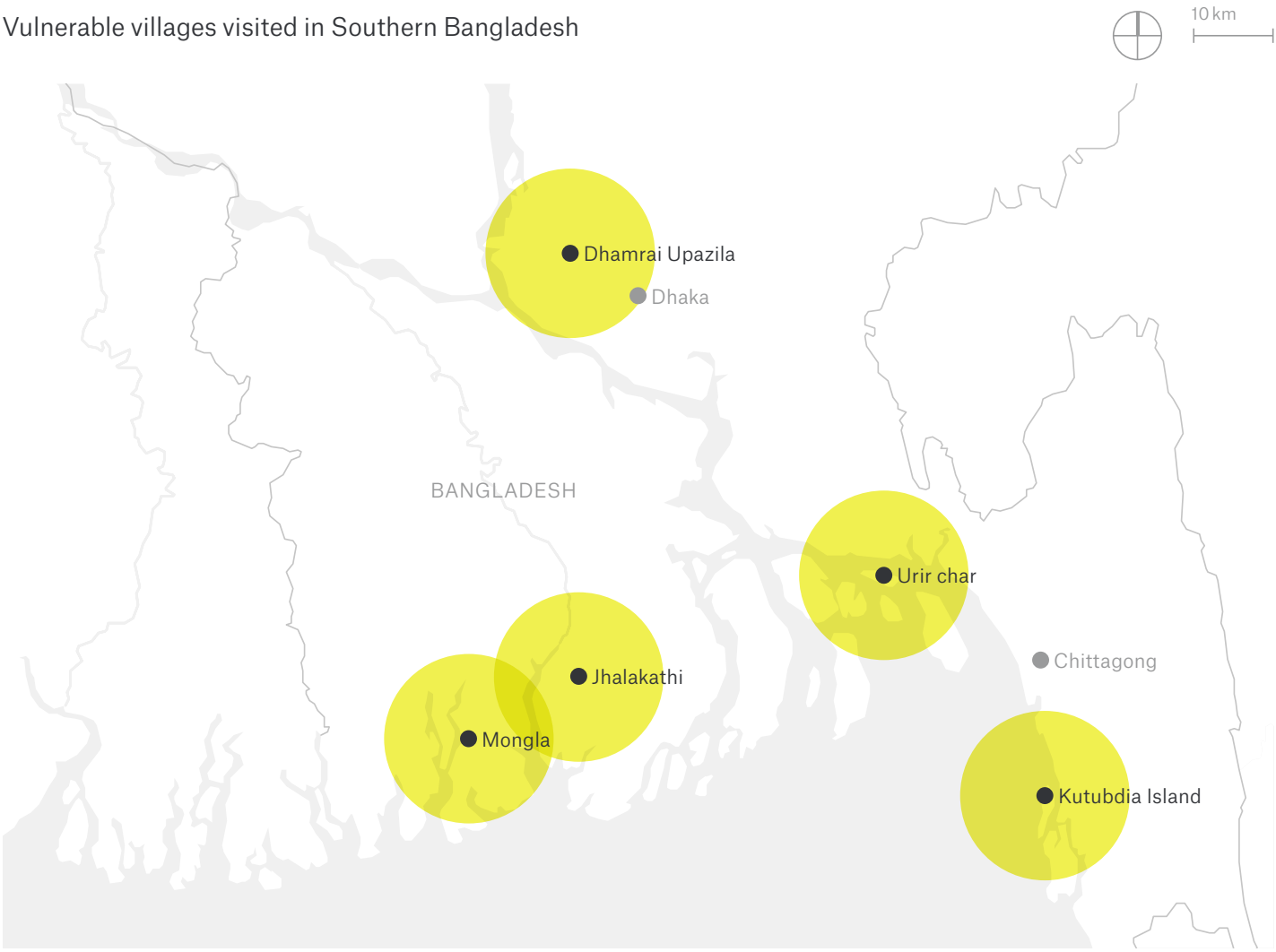
The project team visited four coastal districts and one nearby Dhaka in Bangladesh at the beginning of 2020 and interviewed over 200 household members to assess their vulnerability as a proxy for identifying the most vulnerable location for future disaster-resilient infrastructure research. The five selected communities are based in the following regions:
— Mongla Upazila
— Rajapur Upazila
— Dhamrai Upazila
— Kutubdia Upazila
— Companiganj Upazila

Kutubdia, an offshore coastal island, was selected for further investigation, based on the results of the household vulnerability assessment.

Kutubdia is home to roughly 125,000 residents and 55 communities and villages are located on the island. Despite the fact that the island hosts one of Bangladesh's largest wind parks, access to electricity is a huge issue. The average income on the island is significantly lower than the mean in Bangladesh. The island faces threats from storm surges, cyclones, heavy rain and erosion, amongst other natural hazards. Here, the floating homes as an integrative approach can really make a difference.

The map below shows the 5 localities initially selected for the RISK Award vulnerability assessment.

Vulnerable villages visited in Southern Bangladesh



1.19m

fatalities worldwide due to disasters between 1980 and 1999 (CRED, UNDRR, 2020)

1.23m

fatalities worldwide due to disasters between 2000 and 2019 (CRED, UNDRR, 2020)

50%

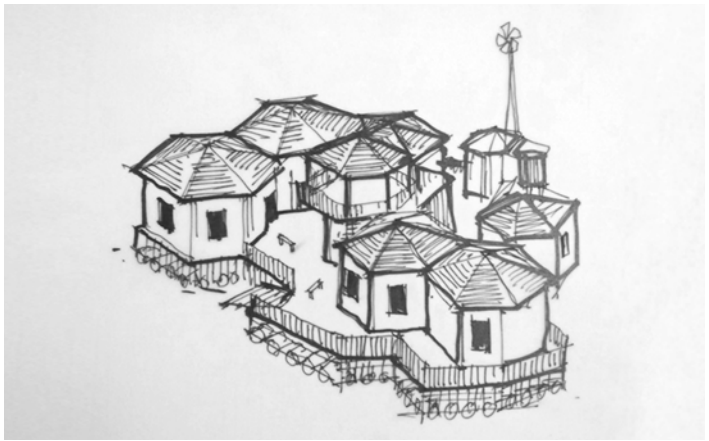
of the world's population will live in coastal areas exposed to hazards in 2030

Living conditions on Kutubdia are often harsh. In many cases, buildings do not meet official building standards and therefore offer little protection in disasters. The pictures at the bottom are of the village school.

Objective 1
Enhance structural designs for coastal regions

The first goal was to improve the existing design of flood-resistant homes in order to have the greatest possible impact and likelihood of adoption in coastal zones and beyond. The following activities were carried out within the first three months of the project launch:

The community where the original prototypes were built was revisited, and a co-creation and inclusive process was explored with community members to see how the design of the homes could be improved. Construction materials and construction costs were re-examined, and cost-cutting strategies identified, such as exploring the use of prefabricated materials with various private companies in Bangladesh. Structural issues were investigated in relation to what is required to make coastal homes more effective, taking into account different flooding, wind stress, salinity, and coastal erosion issues. Experts with experience in these areas were then consulted to help improve structural and architectural designs.



Top: According to the project surveys, people in communities threatened by natural hazards are more likely to trust in massive stone buildings to provide shelter, like the Flood and Cyclone Shelters in this image.

Bottom left: If new types of houses made from renewable raw materials are to be truly successful, a change in thinking must take place among the potential users of the houses.

Bottom right: Participatory processes, such as those used here to interview children, can support societal acceptance.

Key outcomes of the focus group discussions

Displacement is the last resort
People do not want to be relocated from their home location. While the demonstration home was built on the riverbank to gain first-hand experience with a floating home on the Ganges, the site was isolated from the village's core settlement area. Living apart from the core community also increases the likelihood of being mugged or abused by those who are envious at not being the direct or indirect beneficiary. As a result, selecting an appropriate building site for the demonstration project became a critical learning experience for the research team. The new homes must be embedded in existing social structures.

Unsure about the income from the home
The new houses should also generate income. Vertical farming is just one idea among many. However, due to a lack of empirical data, it was difficult to predict exactly how much income could be generated. Extremely low-income, vulnerable families were selected as beneficiaries for the prototype houses after an in-depth vulnerability study. Due to their personal situation, they were very risk-averse and did not trust the new possibilities of the floating homes. They were also not ready to invest time and money. Consequently, the RISK Award project team had to engage in further education and capacity training to really bring out the benefits of the new homes.

Mistrust between the project team and the community
There were specific power structures in the prototype community. These could not be completely penetrated even after the project team had been present for a year. Some of the regional leaders in this structure feared a loss of their power and influence if the project was too successful and thus brought families into the limelight who had not been there before. Rumours were also spread that the new way of living was intended to bring about a religious conversion. In the end, these rumours led to mistrust between the project team and the beneficiaries and many other residents. As a consequence, a hybrid top-down and bottom-up approach was adopted for the new project. It was also decided not to "give away" individual houses to a few selected people, but to develop the concept to make it fully ready for the market and then make it accessible to all interested parties free of charge.

Fear of new technologies
The community group members were trained in all aspects of the technology-heavy home initiative. However, they suffered from a lack of confidence that they could operate and maintain the project after the external support ended. Furthermore, they were apprehensive about averting any risk of technological features breaking down and about covering the cost of maintaining the home. The critical learning experience from this concern is the lack of depth of the training and awareness-building programme undertaken as part of the last initiative.

Social status quo
A home is not only a private living space occupied by an inhabiting family. A well fabricated and aesthetically pleasing home is also a representation of social status in the community landscape. In this context, building material plays a significant role. Concrete or brick-built houses are more expensive and were ranked as first choice for most of the rural households. While it may be aesthetically pleasing and an environmentally friendly choice to live in a bamboo hut, it does not appear to appeal to the participating members due to their deeply rooted socio-cultural status quo. Local people's preferences for building materials and building culture need to be given priority. Awareness raising about the use of environmentally friendly and disaster-resilient floating homes cannot be achieved in a hurry.

Objective 2
Enhance process designs that empower beneficiaries

The second goal was to create a process design that can be used in larger-scale projects aimed at empowering disadvantaged families in communities impacted by flooding in coastal regions. Participation and empowerment were the two core parts of this project goal. Insights from other projects, as well as lessons learned from the initial prototyping project, had inspired the process design. The participation of all relevant stakeholders, including future beneficiaries, was secured via different formats. Over 500 local-level beneficiaries in the project neighbourhood were allowed to express their own wishes, expectations and fears in 55 focused group discussions and co-design meetings.

Top left: Specific changes to the building plans were discussed in small local co-design workshops.

Top right: The ideas for the new houses were presented to all villagers, especially women and children. Feedback processes were also important here.

Bottom left: In line with the wishes of the beneficiaries, traditional building methods should find their way into the building plans.

Bottom right: The floating homes should not only fulfil their purpose as resilient houses, but also be aesthetically pleasing. The concept combines both requirements.

Four main aspirations for the floating homes have been defined. Firstly, the house should be resilient to several different natural hazards, such as storms, heavy rains and floods. Earthquake resilience usually plays a role as well, but Kutubdia is not prone to that hazard. The designers of the house always advocated a strong sustainability vision. This was echoed by the beneficiaries and resulted in the second aspiration: the environmental footprint should be minimised when actually building the home. Especially during monsoon times, whole regions in Bangladesh are left under water. During that time, energy and food security are of the utmost importance. This led to the third aspiration: the house should be self-sufficient in terms of food, water, and energy. The forth aspiration was more a qualitative one and therefore less easily measurable: the beneficiaries wanted a solution that, on the one hand, was innovative enough to meet the three previous aspirations. On the other hand, it should fit into their traditional, social and financial context. Only when this balancing act has been achieved can one really talk about a home instead of just another house.

Affordability is key

Based on these four principal wishes, concrete planning instructions were formulated for the design team. First of all, the house must be affordable. The prices of well over US$ 10,000 that would normally have been charged for the prototypes are not realistic. If the project is scaled up, the price should drop to under US$ 4,000. This could be achieved in the course of the project. In the meantime, project leader Nandan expects costs of about US$ 2,500 if the production of several hundred houses proves feasible.

20

professionals of the house building sector have been trained during the project

Guidelines for the planning process

— Aesthetically pleasing while fitting in with the local building culture
— Off-grid, passive house with net-zero energy demand (met by solar PV, wind turbine, biofuels), ensuring thermal comfort and natural ventilation with ample light and air
— Built with natural building materials, such as bamboo, wood, limestone and soil
— Self-sufficient in food thanks to permaculture (aquaponics and hydroponic applications)
— Sustainable drinking water provisions that include options to harvest rainwater
— Disaster-tolerant house built over a buoyant platform and structural design consideration for wind stress tolerance, including protection against salinity and fire
— Waste management system with grey water filtration system and waste fed to the biofuel conversion facility
— Prefabricated house ensuring mobility and the minimum involvement of an on-site labour force
— Different architectural and financial variants for the poor, medium- and high-income categories, with geographical applicability in the hot and cooler climatic regions

Participation of local stakeholders

Every step of the project team's development was discussed with the local beneficiaries in feedback rounds. In the end, the floating home should not be purely a technical work from a group of experts, but something inspired and shaped by the participation of the local population. At the end of the project period, the result was clear and a building and planning concept was available that included all the aims and wishes from the co-design meetings. In parallel with the development of the houses, ideas for the knowledge hub (such as a floating school, see objective 3) were also developed during the project. Based on a series of design workshops conducted in the field that included feedback from around 50 experts, the design team finally created a pre-concept for a disaster-resilient education hub based on the same concept as the previously planned disaster-resilient home.

Objective 3
Develop appropriate frameworks to ensure transformational change

Many development- and resilience-related project proposals promise transformational outcomes. Yet when implemented, they often fail to do so. While there are many reasons for this, a key cause of failure is a lack of explicit attention to establishing appropriate frameworks that guide actions towards systemic forms of change. Small-scale solutions often do not have the impact and visibility needed to bring about long-term behavioural change. This is also a difficulty with floating homes.

Sustainable concepts needed
The pilot project on the Ganges fell down because the focus was more on the houses and less on the social context. The way people live, with "home" as their central focus, cannot be changed quickly. First, there needs to be an understanding of the external drivers for change (such as climate change causing sea level rise, flood events and more). Then there has to be an inner readiness for a new form of housing. The project team led by Roufa Khanum believes they can do this in Kutubdia: "Upscaling of the implementation of the innovative floating homes provides exciting opportunities beyond the scale of a single family within a community", she explained.

The RISK Award project is therefore not just about a new architectural concept for an amphibious house. Rather, all sustainability criteria (social, ecological and economic) are to be taken into account from the very beginning and throughout the entire process. Starting with the participatory planning of the house, and regional value and supply chains during construction, through to living in the houses themselves.

A floating school as facilitator and change enabler
Projects like the RISK Award can implement certain things efficiently due to their size: For example, they can implement small-scale pilot projects or develop innovative concepts. However, they are only partially suitable for directly bringing about large-scale behavioural change or massive changes to infrastructure. So it was never the goal to build many individual houses with the available budget, but rather to act in perspective and to develop concepts for scaling. The planned funding e.g. from the Adaptation Fund will then help to massively increase the number of actual houses. In order to become as tangible as possible as early as the concept phase, the project team has developed the idea of a "knowledge hub" together with the Munich Re Foundation. All the knowledge that is available on the Floating Homes is to be incorporated there. A specific community house is to be built as a floating school.

The school combines several advantages: if it is implemented and, for example, supervised by a local NGO, it serves all residents of the community equally. There is no privileging of different groups. In addition, the school can serve as empirical visual material when it floats during floods. People can see for themselves that the concept works. And in the school, the concept can be further disseminated through capacity training workshops and ongoing dialogue, which ultimately leads to the desired behavioural change. The residents then make the decision for the floating home themselves when building a new house.

The school and the houses will thus go hand in hand in the future. The first major investments are to make the construction of the floating schools possible. Subsequently, people will be able to decide for themselves when and how to switch to the floating homes.

The house and the floating school can be structurally combined. The goal is to provide a platform for exchange and learning.

In the course of the project, both concepts (school and house) were developed to market maturity. In both concepts, important principles are taken into account, which will contribute to transformational change:

The Role of Biomimicry
Biomimicry is the emulation of nature-based solutions by imitating biological entities and processes that provide ecosystem services to maintain a balance in the environment. Based on this philosophy, the climate-resilient structures have been designed to follow the six unique characteristics of beehives: hazard-resilient hexagonal form, co-design-based formation, self-sustenance in terms of food security, internal climate control, modular expandability and ecosystem services. The design of this climate-resilient multipurpose school is an attempt to spread the design philosophy of climate-resilient homes throughout the younger generation of society.

Hazard-proof design
The house, designed on a hexagonal amphibious platform, can float in about 10 feet of water during extreme tidal flood or storm surge events. The structural integrity of the house remains intact up to an earthquake measuring eight on the Richter scale. Furthermore, it can withstand a Category 3 sea cyclone and subsequent storm surge and wave action.

Self-sustenance
Food security: The climate-resilient school provides healthy lunches for all its students. A balanced intake of protein, carbohydrates, and vitamins for a total of 120 children is carefully calculated to ensure nutritional security. Chicken, eggs, and non-toxic vegetables are produced in the school's aquaponics system. Moreover, other grains and materials, including rice and pulses, are procured from the agricultural produce in the aquaponics and poultry system. The main objective of the midday meal is to promote a healthy younger generation's development to lead climate-resilient development in the future.

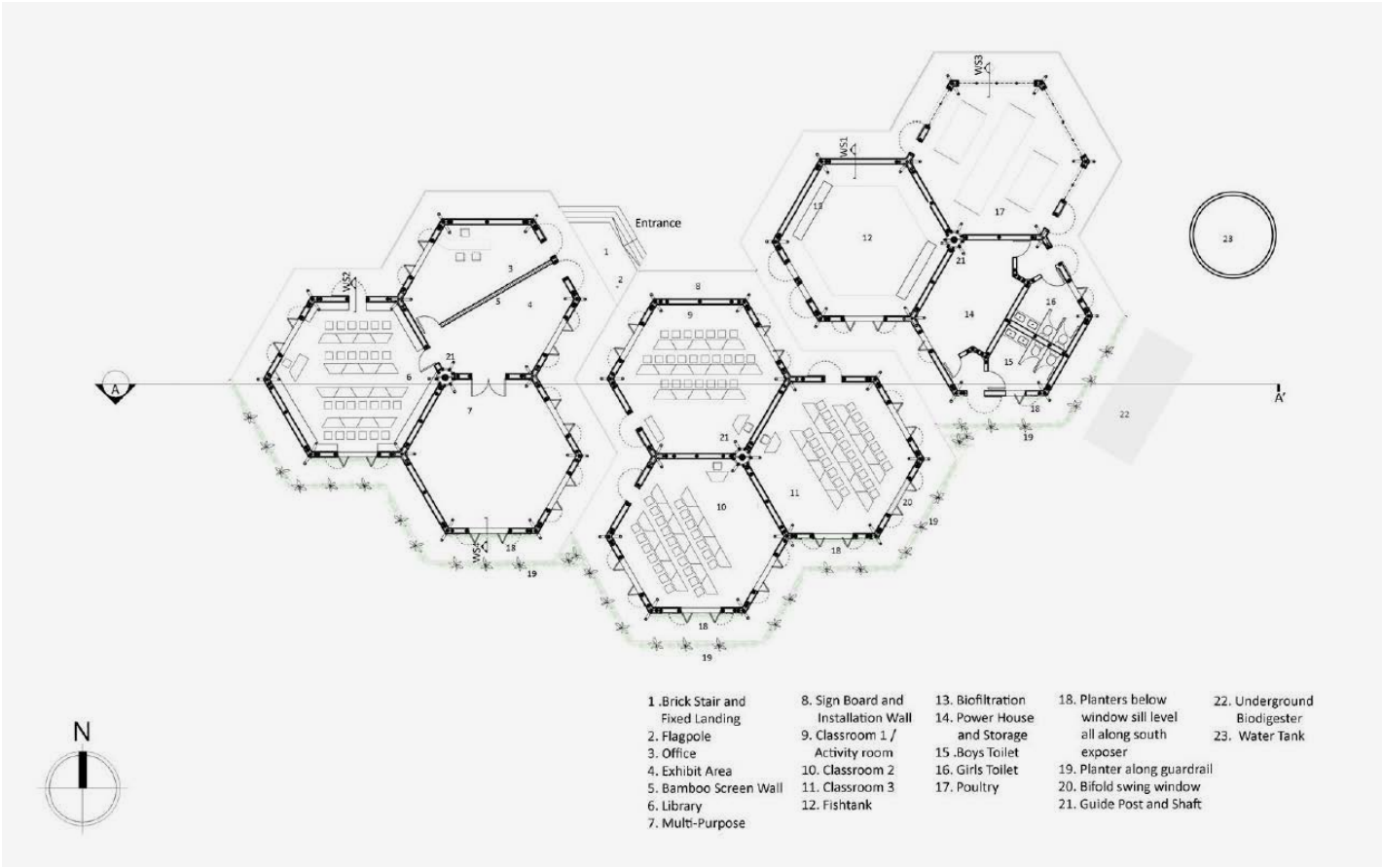
Objective 3
Develop appropriate frameworks to ensure transformational change

Continued

Income generation: The school earns a minimum of US$ 1,800 per month by selling agricultural produce from the poultry and aquaponics system. This covers the cost of production and pays the salaries of six school teachers, a school manager and a cook. Minimum fees received from the school children are deposited in the school's emergency management fund. Proceeds from the supply of renewable electricity to nearby homes through the nanogrid facility are also deposited in the school's emergency management fund.

Internal climate control: Net zero ambition
The school meets 100% of its energy demand through three renewable sources: a solar PV system, wind turbine, and biodigester. Energy-efficient strategies, including natural ventilation, shading, structural orientation and airtightness are incorporated into the design to meet the "passive standard" of the tropical region. This means that the school does not rely on any fossil fuel-based or grid electricity to meet its energy demands. The maximum internal temperature in summer stays below 27 degrees Celsius, while the minimum temperature in winter is 17 degrees Celsius.

Modular expansion is possible, similar to the structure of a beehive.



Modular expansion
Three units of the individual hexagonal amphibious form of 584 square feet each are grouped and floated together as a single module centred on a single guidepost. Additional modules can be incorporated along any arm of this hexagonal module, allowing flexible future expansion.

Co-design process
Stakeholders, irrespective of gender, livelihood or age group, are involved in every step of the design process. Furthermore, the design process has evolved in harmony with the surroundings, natural environment, built culture, and social system.

Ecosystem services
Regulatory Service: Zero environmental footprint
Bamboo has been used as a building material in 95% of cases. The main reason for not using concrete, steel or bricks is the significant emission of greenhouse gases that would result in the production process. The main reasons for using bamboo are its ease and local availability, short growth cycle, versatility of use, environmentally friendly properties, and pliability. The tensile strength of bamboo is close to that of steel, enabling it to be bent sufficiently, and giving the bamboo structures extra stability during storms or earthquakes. The use of fossil fuel-driven heavy machinery or power tools has been strictly limited in the construction plans to minimise the environmental impact. The overall environmental footprint is minimal as the house is built using mainly hand labour by local craftsmen and skilled artisans. Moreover, other environmental impacts have been kept to a minimum through special monitoring of dust and sound pollution, keeping the topsoil layer intact during excavation, and construction waste management.

Provisional service: Safe water supply
Rainwater is collected and stored in an underground reservoir with a capacity of 310,000 litres of potable water. This water is filtered in two steps using a slow sand filtration system to meet the drinking standard. Total water demand is calculated by measuring the demand from the school's students and teachers, the demand for fish and crops in the aquaponics unit, and the demand for the products of the poultry unit throughout the year.

50
national experts were involved

2,500
USD is the cost for the new houses if produced in high numbers

Objective 4
Develop appropriate business and finance models

The primary output for this objective was the creation of a finance and business model. The basis for the business plan was a large market study covering more than 1,000 households in Kutubdia and the surrounding area. Initially, this was planned for summer 2020. Due to the rampant coronavirus pandemic, however, the survey could not be conducted until early 2021. Nevertheless, the responses provided valuable insights into the potential market volume for floating homes. In particular, the survey clarifies the tenure, housing and income situations of the target population.

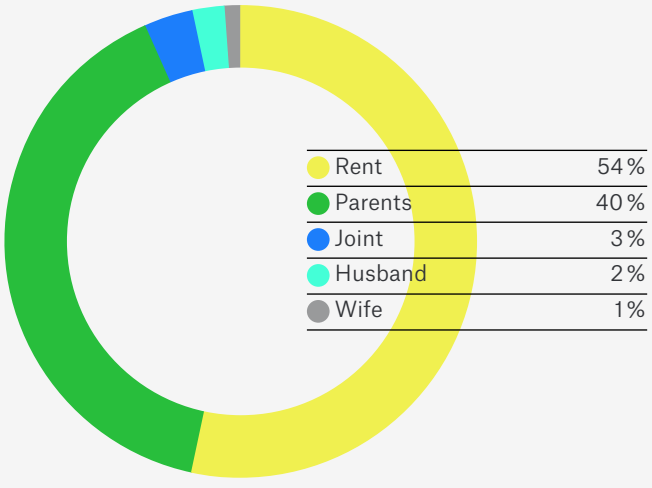
Land ownership is often the factor that lifts people above the poverty line in Bangladesh. Land is important as a home, but also as a source of income. The loss of land, on the other hand, often threatens people's existence. The graphs below show very clearly that an immense part of the population in Kutubdia owns land itself and also uses it for income from agriculture. Floating homes can significantly increase the value of the land because it remains habitable during floods and standing water, and can continue to generate income through integrated farming systems.

The study also analysed regional supply chains and found out where and how much regional building materials can be supplied. In the end, the business plan contains clear recommendations on supply chains and manufacturers. Of course, this has to be adapted depending on the particular project region.

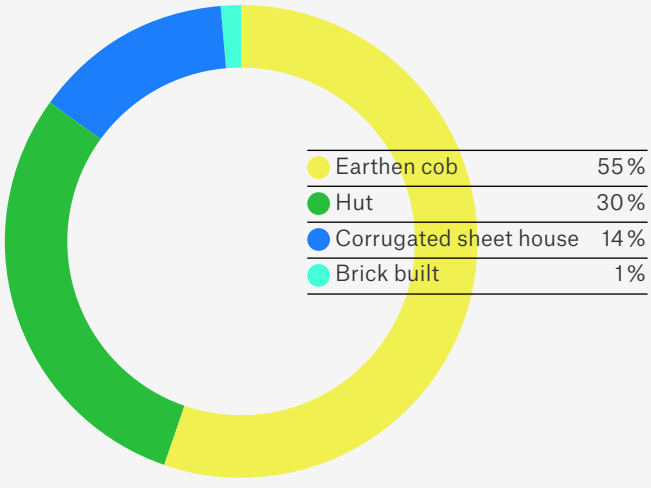
Making use of economies of scale

The prices for the houses were and remain a serious issue, especially with low-income residents in this area. A local corrugated sheet house, which is used by almost half of the inhabitants, costs between US$ 3,000 and US$ 4,000. The price of the floating home would need to be in this range to become relevant. The prototypes from the Ganges still cost around US$ 12,000. Built individually, the newer RISK Award houses would also cost around US$ 10,000. However, if economies of scale can be achieved, the unit prices can be reduced to well under US$ 4,000, according to the results of calculations by the project team based on the study data.

What is the type of landownership?
In percent



What is the structural type of your home?
In percent



Top: In the course of the market study, it was investigated where the best local building materials for the floating homes could be found, and which transport routes would have to be priced in. Here in the picture, bamboo is transported along rivers.

Bottom: Possible delivery scenarios were discussed with manufacturers in case larger order quantities should be required.

What is the principle income source?

Number of answers

In the course of the business plan development, more than 1000 households were interviewed about their living situation. The diagrams show selected results of this market study.

Agriculture	
Primary	93
Subsidiary	4

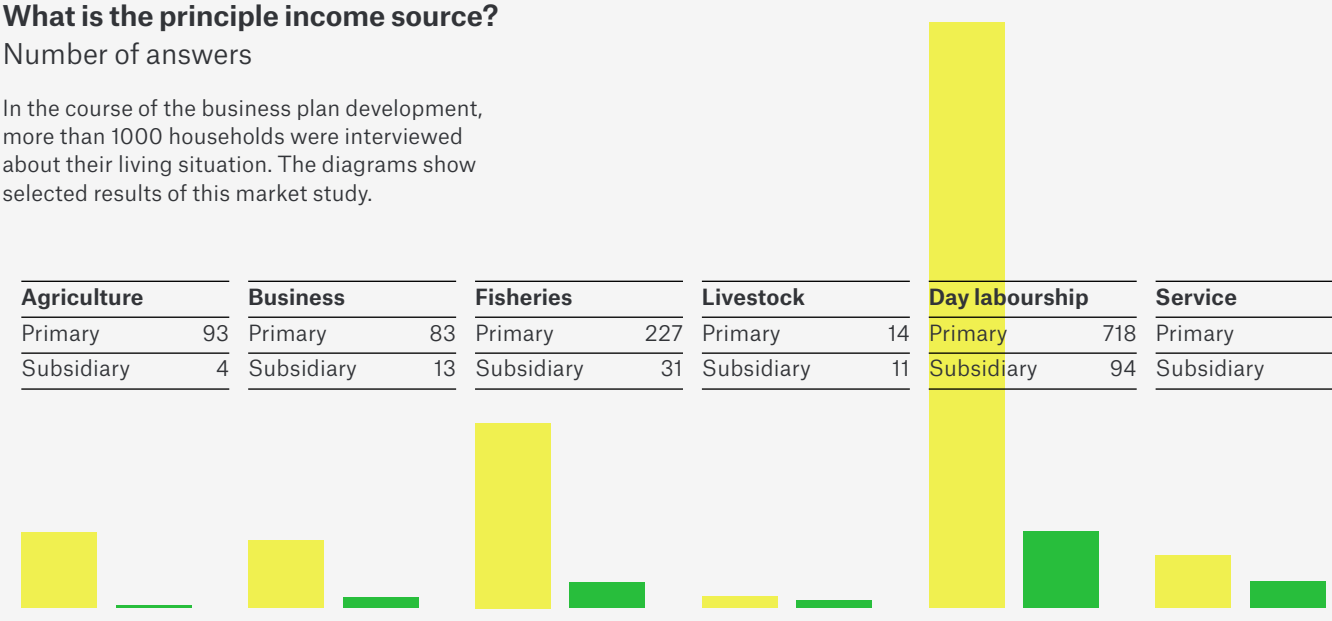
Business	
Primary	83
Subsidiary	13

Fisheries	
Primary	227
Subsidiary	31

Livestock	
Primary	14
Subsidiary	11

Day labourship	
Primary	718
Subsidiary	94

Service	
Primary	64
Subsidiary	33



Objective 5
Develop public-private partnerships

The fifth objective was to build private and public partnerships. The objective aims at developing partnerships and potential avenues for collaborative approaches to scale the implementation of the homes. Furthermore, it serves to ensure the continuation of the project after the end of the RISK Award funding and to gather further opinions, suggestions and ideas about the project.

Implementing upscaling requires diverse public-private partnerships for finance and delivery. Various organisations, such as Bangladesh-GIZ and UNDP, had already expressed an interest in taking the prototype homes to the next level before and at the beginning of the project. Work was needed to develop these partnerships while also exploring and developing others, such as government departments in Bangladesh, like the Ministry of Finance, Ministry of Disaster Management, Ministry of Environment and Climate Change, local organisations, BRAC and other NGOs, and with private partners such as Kushali Engineering Ltd.

Nandan Mukherjee (Dundee University) and Roufa Khanum (Resilience Solution Bangladesh) talk with participants at the Stakeholder Consultation Workshop.

Networking is important
These relevant stakeholders were consulted during the project inception phase at a national workshop at the end of 2019, when the site selection criteria and conceptual design of the resilient home were presented. Furthermore, possible forms of cooperation were explored during bilateral meetings in Bangladesh. While the nature and successful development of these partnerships cannot be guaranteed, the project team's extensive existing networks and relationships with various organisations within and outside Bangladesh will ensure maximum potential for this goal.

A Stakeholder Consultation Workshop was held by Resilience Solution on 4 November 2019 at the AS Mahmud Seminar Hall in the Daily Star Centre, Dhaka. In technical sessions during the workshop, the 32 participants learned about and discussed the facilities of the "Disaster Resilient Floating Homes" and heard about the field investigation that took place in 5 coastal areas of the country, including Mongla and Kutubdia. Each stakeholder had the opportunity to contribute ideas and provide feedback. The architect behind the design, Pritthijit Kundu, praised this participatory approach and summarised the outcome from the discussions: "Only through the active participation of all stakeholders can we ensure from the outset that our new concept leads to success. We must prevent social groups from feeling excluded."

Further developing the floating school concept
A second workshop titled "Disaster Resilient School Design" was held on 21 October 2021 in Dhaka, Bangladesh. This workshop was based on the project expansion to include a disaster-resilient school and community centre.

The following were the key decisions from this meeting: The University of Dundee agreed to implement the infrastructure for the new floating house prototype with the assistance of the local partner, Resilience Solution. A Memorandum of Understanding to support this process was signed by the University of Dundee, BRAC University, the Scottish Government, and the UNESCO Centre for Water Law, Policy and Science. The Munich Re Foundation will remain a collaborator and advisor in this endeavour.

The results of the conceptual work for the RISK Award were compiled in a project application to the UN Adaptation Fund. A National Implementation Entity (NIE) in Bangladesh must be found to officially submit the application to the Adaptation Fund.

The second workshop titled "Disaster Resilient School Design" brought together national and international experts.

Discussion round at the "Disaster-Resilient School Design" workshop in October 2021.

Objective 6
Dissemination of outputs

The sixth objective places a strong emphasis on dissemination of results, firstly to enable others to benefit from the actions that led to the designs, concepts and frameworks, and secondly to lay the groundwork and raise awareness for wider public participation in future upscaling activities.

For example, a video documentation of the project was created to increase its visibility among the general public. This is freely accessible on YouTube and is promoted via several social media channels. The University of Dundee's Twitter channels, with more than 175,000 followers, are among those used. The results are also shared through the RISK Award project partners Munich Re Foundation and UNDRR and their respective websites.

→ https://youtu.be/GWHgFp4L5PI
→ https://youtu.be/x14mFjxTpRQ
→@dtdchange twitter feed
→ www.risk-award.org

A more targeted national dissemination of the idea of floating homes was aimed at through the workshops mentioned in objective 5. The numerous content partnerships will further fuel the idea. The Bangladeshi media also play a major role in increasing visibility at the national level. Articles have already been placed in several media.

The proposed floating school will play a leading role at the local level. The residents in and around Kutubdia and beyond can learn and experience here on site what the concept of "floating homes" means. And that it goes far beyond a mere housing concept.

Throughout the project, a fair gender balance was aimed for. The local consultation workshops as well as the interviews for the surveys were aimed at men and women equally.

Floods will continue to be a massive problem for Bangladeshis in the future. Holistic resilience-building solutions must be found.

The way forward

Intensive project work lies behind the team from the University of Dundee and Resilience Solution in Bangladesh. Many project milestones were affected and hindered by COVID-19 and countermeasures against it. In particular, the on-site activities that would have reached larger groups of people were often not possible. Nevertheless, the project team managed to achieve the set goals. The original project plan specified a period of one year. This could not be maintained due to the pandemic and was extended by one year in consultation with all the project partners.

Outlook

The project team has received a further grant of GPB 30,000 from the Scottish Government. This money will be used to build two prototypes south of Dhaka as demonstrators and, more importantly, to test and establish supply chains.

The first floating school in Kutubdia should then be built in 2023. The results from the UN Adaptation Fund application are awaited. If it is successful, hundreds of houses benefitting thousands of people and several schools can be constructed. At the same time, it is the hope of the project promoters that people will decide for themselves to use the floating homes alternative when building a new house as a result of the educational work.

We wish the project team all the best and every success in implementing the concept. We will, of course, remain as a contact and advisor and look forward to further joint successes in the future.

500

homes to be built

10

resilient schools to be built

Top: The prototype of the floating home worked on a technical level but failed socially.

Bottom: The new concept takes a more participatory approach. The result looks much clearer and is more closely aligned with traditional ideas.

3,000

people to live more resilient

The risks posed by population development, environmental and climate change are increasing. Complex technical systems and infrastructure are additional risk factors. The RISK Award partners recognise the need to address this development. This award has been set up to improve risk reduction and disaster management by providing financial support to projects dedicated to this topic. We want to support innovative ideas, to help them develop further and to scale them. Visibility, impact and enthusiasm should be embodied in the projects. Climate change, disaster risk reduction and sustainable development must go hand in hand to secure the future. For this reason, our projects are in line with the 2015 Paris Agreement, the UN Sustainable Development Goals (SDGs), and the Sendai Framework for Action.

The RISK Award, endowed with €100,000, is assigned to operational projects in the field of risk reduction and disaster management. The prize is awarded every two years. The endowment for the RISK Award is provided by the Munich Re Foundation. We use UNDRR's networks and platforms to inform about the topic, select winners, and organise the award ceremonies – on site and online. Together, we can provide the winners with the visibility their outstanding project ideas deserve.

→ RISK Award
→ RISK Award LinkedIn

UN Office for Disaster Risk Reduction (UNDRR)
The UN Office for Disaster Risk Reduction (UNDRR, formerly known as UNISDR) was established in 1999. It is mandated by United Nations General Assembly Resolution 56/195 to serve as the focal point in the UN system for coordinating disaster risk reduction. It advances the implementation of the Sendai Framework for Disaster Risk Reduction and guides and coordinates the efforts of a wide range of partners to achieve a substantial global reduction in disaster losses, and to build resilient nations and communities as a fundamental condition for sustainable development. It is an organisational unit of the UN Secretariat and is led by the UN Special Representative of the Secretary-General for Disaster Risk Reduction (SRSG), Mami Mizutori.

→ UNDRR

Munich Re Foundation
The Munich Re Foundation is an independent, non-profit organisation founded by Munich Re in 2000. People are ultimately at the core of the foundation's work. The foundation's task is to prepare people for the risks they are exposed to and to minimise these risks wherever possible. It clarifies issues and provides support, including in developing countries. In dialogue with partners worldwide, Munich Re Foundation stimulates ideas and creates perspectives.

→ Munich Re Foundation

UNDRR
UN Office for Disaster Risk Reduction

Munich Re Foundation
From Knowledge to Action

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