DESIGNING A SHELTER FOR REFUGEES IN LIGHT OF SUSTAINABILITY

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Abstract

The most important questions about the design of refugees' habitats are simple ones. Can architecture contribute to saving lives of refugees, and offering them enhanced quality of life, how can architects repower the new techniques of sustainability to offer suitable, affordable, smart, and practical, people-oriented places for refugees, and what characteristics should these places have? These questions will be answered through three case studies that demonstrate how sustainable design can be a key in solving the refugee crisis. Only by answering these questions can we take a step forward on the way to a new perspective by leading a better quality of life for refugees.

Architecture can contribute to saving lives and enhancing quality of life. Fabrication and advancement in using computerized systems in building and construction could potentially tighten the gap between need and desire, leading humanity to develop the life of homeless, poor and unprivileged people. Nowadays, manmade conflicts have spread across countries. With waves of mass displacements as collateral damage the world has witnessed the displacement of millions of people across continents

Sustainable design solutions for refugee's habitats are the issue of this paper. It aims to examine a variety of developed sustainable design criteria to create a dynamic, zero-energy design, using local resources, which can adapt to the environment and human needs of refugees, and help designers create productive settlements and produce more humanitarian living environments.

The study provides a set of recommendations to visualize both present and future needs of refugees to survive in new perspective of considering climate change and the lack of basic world resources; opening an extended horizon for sustainable architecture to respond positively to environmental disasters and react appropriately to sudden local and/or global risks.

Keywords: refugees shelter, quality of life, sustainable design

1. Introduction

Human life throughout history has developed in alternating waves of migration and settlement. The movement of people across the earth led to the discovery of new territories as well as the creation of new communities among strangers, forming towns, cities, and nations. Navigating this duality between exploration and settlement, movement and stillness is a fundamental essence of what it means to be human.

Architecture can be an aid to saving life of refugees. Improvement and progress in using computerized systems in building and construction could potentially tighten the gap between need and desire, leading humanity in developing the life of homeless, poor and unprivileged people. Nowadays, manmade conflicts have spread across countries. The world has witnessed the displacement of millions of people across continents. Refugees whether in their areas of origin or host communities seek shelter, safe haven from disasters, carry from their homes what they can and resettle in unknown lands.

2. Scope of research

The importance of the research lays in how to foster sustainability as the main basis for refugee's shelters and how to connect design and sustainability in application.

3. Research Aims

The aim of this paper is to set criteria for the sustainable design of refugee' shelters to maintain a certain quality of life for their residents. These criteria of design help us get recommendations which help designers of refugee's shelters, while considering social differences and climatic changes between the world environments.

4. Literature Review

There are precedent researches which discuss the problem of refugees and their habitats and the specifications of their shelters such as "SHELTER PROJECTS" which exposure case studies of humanitarian shelter and settlement responses and is published every year [11].

In this regard, there are also documents like "shelter design catalogue" by UNHCR, the United Nations refugee organization, the Global Strategy for Settlement and Shelter which exposure the concept of shelters worldwide.

But this paper has the originality of Connecting refugees shelters to sustainability and discusses importance that those shelters should apply the standards of quality of life.

5. Research Methodology

The study compares two different examples showing the reasons for their selection. The comparison should be based on a set of lessons learned from them. Those recommendations are made on the situation of the shelters resulting from crisis - For example, the Syrian people, and how to apply the standards of quality of life on its architectural design.

6. Problem Definition

4-1 Global Displacement

As of the end of 2015, 65.3 million people were forcibly displaced from their homes, with 21.3 million being refugees, 40.8 million internally displaced and 3.2 million asylum seekers. In 2015, the number of people displaced was the highest since over two decades, mainly due to the nature of several protracted crises, particularly those in the Middle East, Figure 1. More than 75% of the total displacement was within 10 countries, Figure 2.

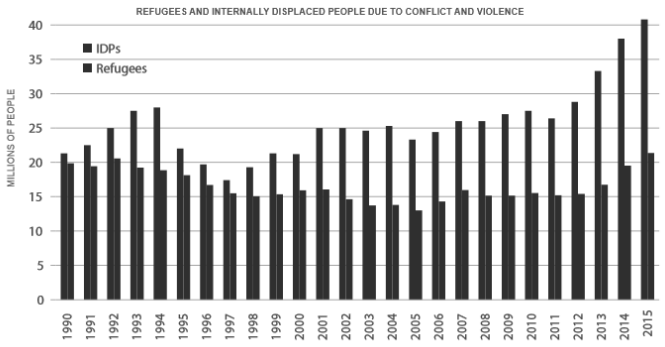

Figure 1. Number of people internally displaced by conflict and violence at the end of 2015. *Source: UNHCR, UNRWA for refugee figures; IDMC and USRC for IDP figures.*

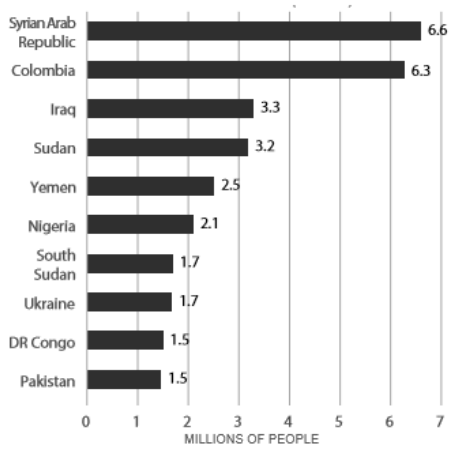

Figure 2. Refugees and IDPs displaced by conflict and violence, 1990 to 2015. *Sources: UNHCR, UNRWA for refugee figures; IDMC and USRC for IDP figures.*

Over the course of the same year, there were 19.2 million new displacements by natural disasters, less than the average of 25.2 million in the previous decade, but almost twice as much as the number of people displaced by conflict and violence in the same year (8.6 million new displacements). Over half of the refugees under UNHCR's mandate in 2015 came from three countries, the Syrian Arab Republic (4.9 million), Afghanistan (2.7 million) and Somalia (1.1 million) [11].

4-2 Natural Disasters in 2015 through 2017

In 2015, there were 371 reported natural disasters (by that time, represented the highest value in five years), affecting over 108 million people [5]. In terms of displacement, India, China and Nepal accounted for the highest numbers of internally displaced people caused by natural disasters during 2015 (3.7 million, 3.6 million and 2.6 million respectively), mainly due to two floods and storms, three typhoons and a flood, and two earthquakes respectively. These were followed by the displacement caused by multiple typhoons in the Philippines (2.2

million displaced) and the impacts of Cyclone Komen in Myanmar (1.6 million displaced) [3]. With the Nepal earthquakes in 2015, the high numbers of people affected in the largest disasters in the world continue to represent a source of concern.

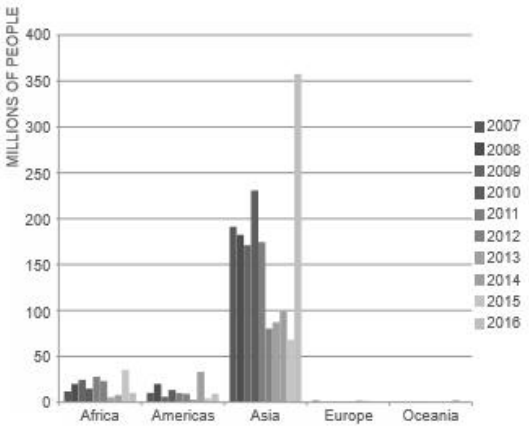

Figure 3. Total people affected by natural disasters, in millions, from 2007 to 2016 (source: CRED). Asian countries are disproportionately more affected. *Sources: UNHCR, UNRWA for refugee figures; IDMC and USRC for IDP figures.*

Figure 3 shows clearly that Asian countries are consistently the worst affected by natural disasters [9]. To complete this argument, the most recent Hurricanes Harvey and Irma have been reported to cause unprecedented severe flooding in Houston and other areas in Texas, USA, and made landfall in the Caribbean and threatens the southeastern United States [Bart], Figure 4. In all cases or displaced survivors, the goal has been always to move refuges out of their homes and into temporary habitats near their work, and then a return to a permanent residence, a process that is in respect of "perspective 2016" to protect refugees in-or close to their areas of origin [6].

Figure 4. Evacuees escaping the floodwaters from Tropical Storm Harvey rest at the George R. Brown Convention Center that has been set up as a shelter in Houston, Texas, on Tuesday, Aug. 29, 2017. *Source: Nooman Merchant and Juan Lozano, The Associated Press, AUG. 29, 2017[9].*

5. Case Studies:

The case studies were selected based on the positive contribution of innovative architectural concepts they presented as a response to the arousing conflicts, natural disasters and multiple crises, these innovative designs reflect a number of experimental concepts on theoretical basis that should be practically realized and examined in reality.

Some of the projects are being in response to protracted crises or during a post-disaster recovery process. Given the scale of emergency shelter needs every year, case studies must have had large-scale impacts. The case studies were also selected to illustrate a diversity of sustainable design approaches to meet refugee's shelter and settlement needs.

5-1 Case study 1: Structural Fabric Weaves Tent Shelters [10]

'Weaving a home' by Jordanian/Canadian designer Abeer Seikaly proposes a disaster shelter for refugees that is based on temporary huts of nomadic tribes. The 'Weaving a Home' proposal was shortlisted for the 2012 LEXUS DESIGN AWARD.

Figure 5 General view of habitats. *Source: Seikaly, A. (2012) Weaving Home. Retrieved from: http://abeerseikaly.com/weavinghome.php on May16th, 2017[10].*

5-1-a Privacy, security and cultural appropriateness

Design is supposed to give form to a gap in people's needs as shown in figure 5: This lightweight, mobile, structural fabric could potentially close the gap between need and desire as people metaphorically weave their lives back together, physically weaving their built environment into a place both new and familiar, transient and rooted, private and connected. In this space, the refugees find a place to pause from their turbulent worlds, a place to weave the tapestry of their new lives. They weave their shelter into home [10].

5-1-b Life span

The use of structural fabric references ancient traditions of joining linear fibers to make complex three-dimensional shapes as shown in figure 6. The resulting pattern is easy to erect and scale into various functions.

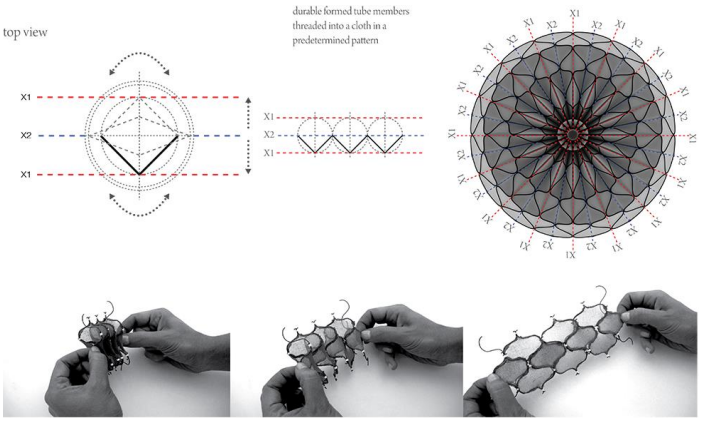

Figure 6 Tensile material. *source: Seikaly, A. (2012) Weaving Home. Retrieved from: http://abeerseikaly.com/weavinghome.php on May16th, 2017.*

5-1-c Size and shape

"Weaving a home" reexamines the traditional architectural concept of tent shelters by creating a technical, structural fabric that expands to enclose and contracts for mobility while providing the comforts of contemporary life (heat, running water, electricity, storage, etc.) as shown in Figure 7[10].

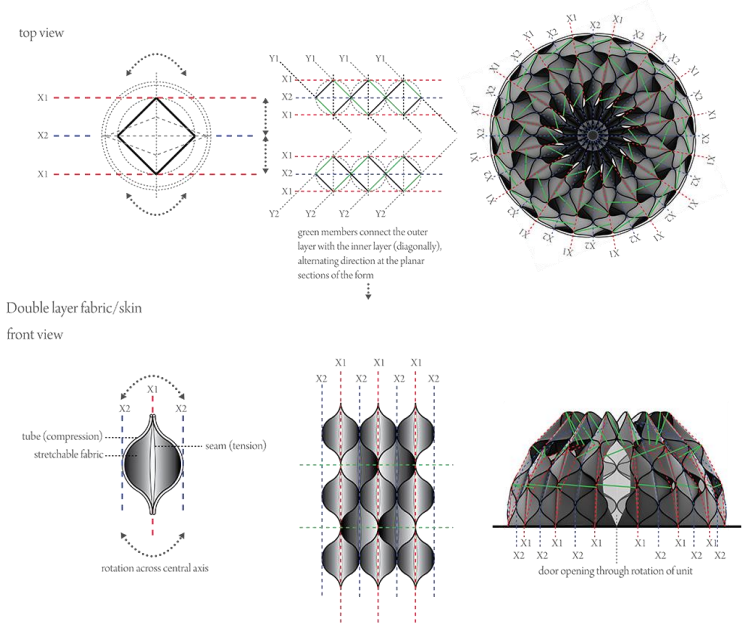

Figure 7. Top and front view of shelter unit. *Source: Seikaly, A. (2012) Weaving Home. Retrieved from: http://abeerseikaly.com/weavinghome.php on May16th, 2017.*

5-1-d Ventilation and thermal comfort

Exposure to the surrounding elements can be controlled by manipulating the units into different scales as shown in figure 6 and opening and closing the exterior skin. The lightweight, structural fabric seeks to help people weave their lives back together, as they construct the mobile pieces into a home [10].

5-1-e Environment

The project incorporates technological advances and new methods of assembly of the material, envisioning a system composed of durable plastic members that are threaded to form a singular unit, with the hollow structural skin enabling necessities such as water and electricity to run through it, Model studies with cut and scored paper are turned into a flexible pattern - illustrated in figure 9 [10].

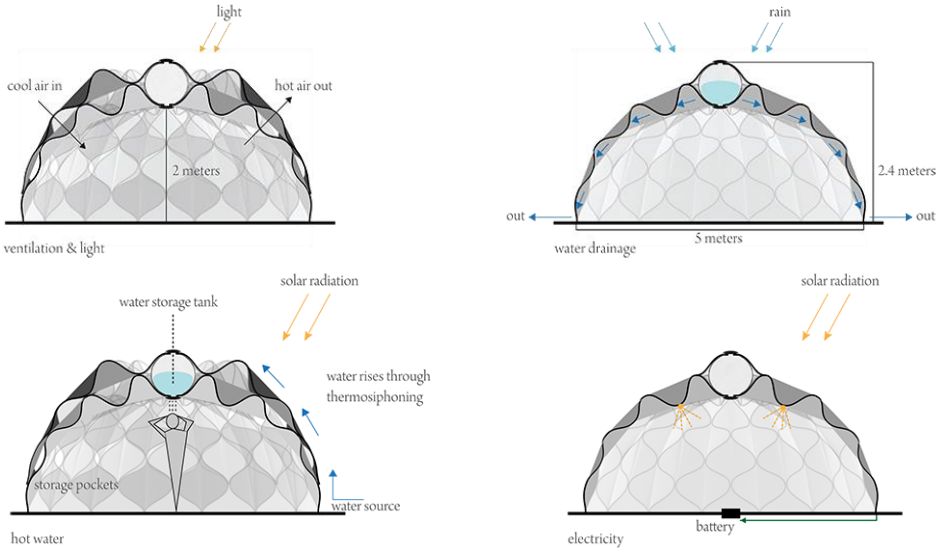

Figure 8. Ventilation and light in shelter unit. *source: Seikaly, A. (2012) Weaving Home. Retrieved from: http://abeerseikaly.com/weavinghome.php on May16th, 2017.*

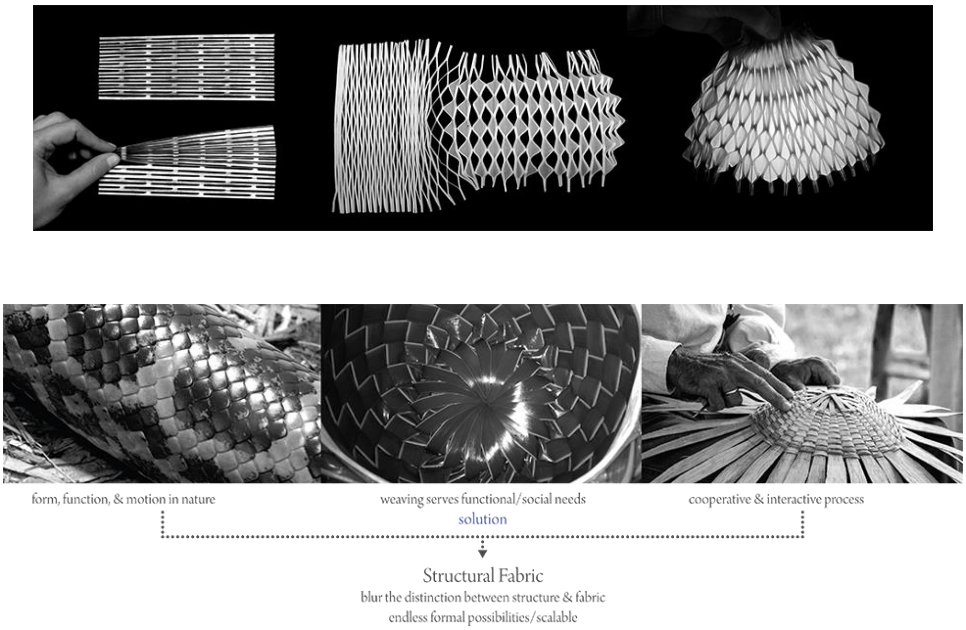

Figure 9. Structural fabric. *Source: Seikaly, A. (2012) Weaving Home. Retrieved from: http://abeerseikaly.com/weavinghome.php on May16th, 2017.*

5-1-f Cost and budgets

The structural fabric is made of natural material so the shelter is not expensive compared to any other rigid shelter made of wood or concrete.

5-2 Case study 2: Flexible Polypropylene Sheets

The Flexible Polypropylene Sheets was the innovative proposal that won 3rd prize offered by the TORINO 2008 Congress organization committee, Dicky Ferdiansyah (Germany): "Flexible polypropylene sheets" [12].

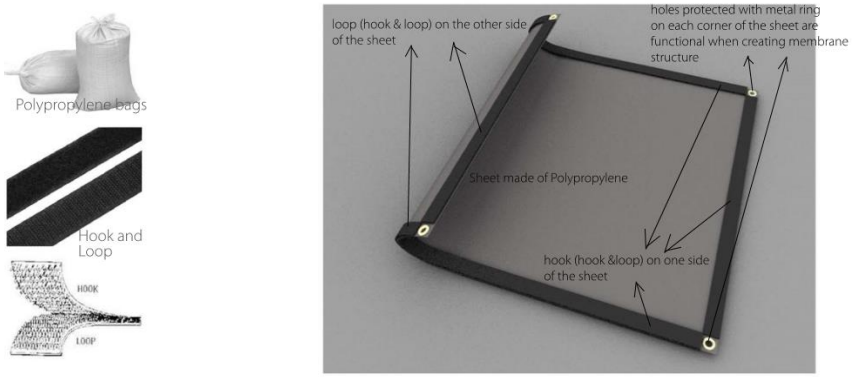

Figure 10. Sand bags details. *source: UIA competition 2008, TORINO, Congress Organization Committee, Dicky Ferdiansyah (Germany): "Flexible polypropylene sheets.*

Sandbag architecture had been used in the war, because it is easy to transport and assembly. For years it has been developed and used by several architects such as Nader Khalili, Akio Inoue and Kelly Hart. The idea of modifying the bag as shown in figure 10 to be flexible and interchangeable into earth bag-membrane, would create playful architecture, where we can play with shape, color, endless combination and characteristics of architecture [12].

5-2-a Privacy, security and cultural appropriateness

Since the building technique is rather simple, it could be learned by refugees in the area, so that they can later build their homes and learn the importance of sustainability since the beginning of learning architecture. The main idea of the project is to create an architectural tool that can be used as a shelter in different areas functions and activities, Figure 11. [12].

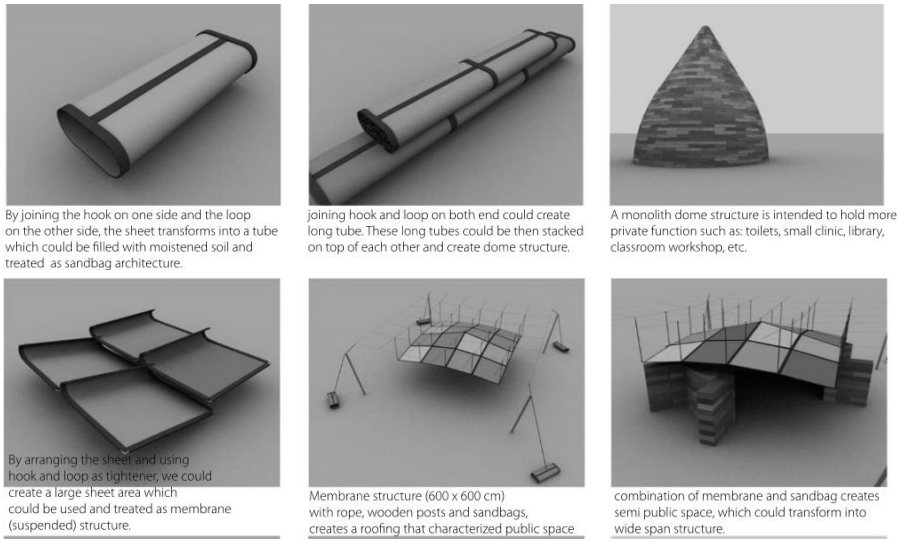

Figure 11. Composition of shelter unit. *source: UIA competition 2008, TORINO, Congress Organization Committee, Dicky Ferdiansyah (Germany): "Flexible polypropylene sheets.*

5-2-b Life span

The architectural topology:

There are two types of architecture in this project; earth architecture in dome shape and membrane architecture. Earth construction techniques has been known for more than 9000 years. It has been used vernacularly as building material. The shape dome is also another solution to create monolith structure, while avoiding the use of different materials for roofing [12].

5-2-c Size and shape

The size should be able to be adjusted depending on the needs (from small to extra-large). Furthermore, it also has to be flexible, easy to transport, easy to be built and sustainable. Functionally, it acts as an architectural object, which is educative and could trigger many other cultural activities, promote health, creativity and could increase living quality for refugees [12].

5-2-d Sustainable strategies- Environment

We can reduce the energy used in manufacturing materials by using sand as a building material. Since earth is reusable, the concept reuse is automatically applied as shown in figure 12. Other sustainable strategies are rainwater harvesting which could be one solution to the problem of poor areas [12].

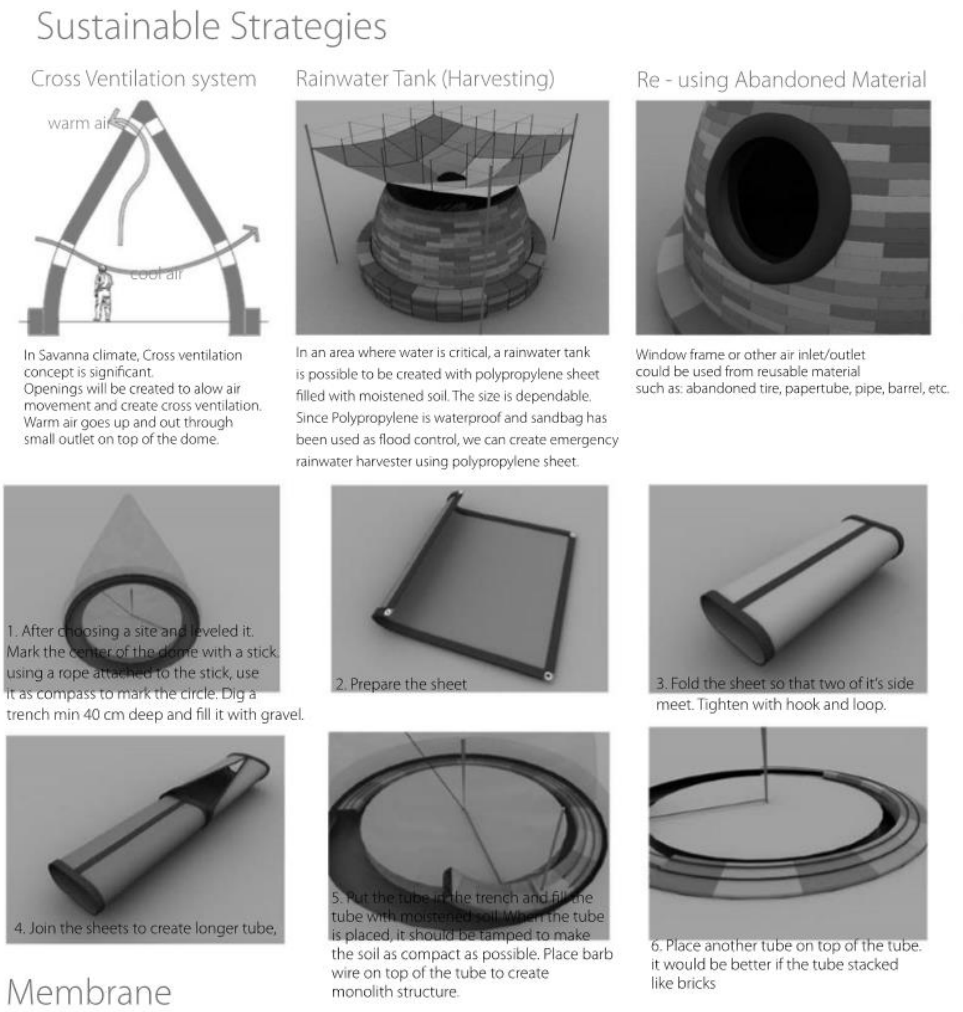

Figure 12. Sustainable strategies. *Source: UIA competition 2008, TORINO, Congress Organization Committee, Dicky Ferdiansyah (Germany): "Flexible polypropylene sheets".*

6. Conclusion

6-1 Privacy, security and cultural appropriateness

Shelter designs, layouts and orientations differ between countries, and even between ethnic groups in the same country. As a result, shelter designs, their layout and their orientation must be adapted to the local culture. In general, the design brief should aim to encourage flexibility in design such as by allowing occupants to add internal divisions for privacy. Remember to consider where activities such as cooking and cleaning take place and what allowances refugees can make for this in the design. In many contexts, additional features such as lockable doors may be required to provide the most basic security [5].

6-2 Life Span

The design brief should specify the amount of time that the shelter is intended to last, given the conditions at the locations in which they will be built. When agreeing the design life of the shelter, if a shelter must last for a long time it may be more expensive and slower to build. Where possible, materials should be reusable and upgradeable, even if families are relocated to different sites. For example, using more durable qualities of timber and bamboo will allow them to be re-used in the permanent house. The specification of a shelter should include detail on the quality of materials required, so that the intended design life of the shelter can be achieved. Materials and design should allow for easy maintenance and upgrade [5].

6-3 Size and Shape

The amount of covered living space that a shelter must provide is a critical determinant of the shelter design, logistics requirements and cost. Organizations need to agree lower and upper bounds to reduce conflict between project sites. A minimum of 18 m^2 covered living space is often agreed in humanitarian responses. This is based on a family size of five and 3.5 m^2 per person, quoted from Sphere indicators.

6-4 Ventilation and Thermal Comfort

The weather varies significantly between disaster locations and with seasons. For large scale disasters the weather can vary significantly across the disaster affected area. People from different cultures will find different buildings comfortable, and be accustomed to different temperatures or humidity. Shelter designs should provide protection from the anticipated extremes of weather. In the case of temporary, transitional or progressive shelters, they should be designed for upgrade with simple winterization kits [5].

6-5 The Environment

A large scale shelter construction project requires large volumes of materials. Consider the environmental impacts of materials being used for shelters, and look at ways to mitigate them. For example, 5000 temporary shelters will require more than 2500 m^3 of timber. Procuring the timber locally might negatively impact upon the local environment, but importing the timber, or using steel may only offset the impacts to another location [5].

6-6 Cost and Budgets

The money available per household for each disaster varies, and is often a critical determinant of shelter cost and ensuing design. As a result, there are significant variations in costs of shelters between responses. When judging the cost per shelter, compare the cost of each shelter with the disposable income of host population. Support given to families in building shelter is usually many times higher than that provided to them in livelihoods programming [5].

7.Findings and discussions:

Shelter is a critical factor affecting survival in the initial stages of a disaster. Beyond survival, shelter is necessary to provide security, personal safety and protection from the climate and to promote resistance to ill health and disease. It is also important for human dignity, to sustain family and community life and to enable affected populations to recover from the impact of disaster.

A shelter is defined as a habitable covered living space providing a secure and healthy living environment with privacy and dignity. Refugees and others of concern have the right to adequate shelter in order to benefit from protection from the elements, space to live and store belongings as well as privacy, comfort and emotional support.

Shelter should be adapted according to the geographical context, the climate, the cultural practice and habits, the local availability of skills as well as accessibility to adequate construction materials [13].

8. Recommendations

To attain better quality of life in refugee's shelters, it is recommended to adopt the following architectural design guidelines:

- It should maintain a certain limit of quality of life, thus be acceptable to the affected population, providing sufficient thermal comfort, fresh air and protection from the climate to ensure their dignity, health, safety and well-being.
- Design for refugees' shelter should be more than simply designing architecturally impressive structures; looking beyond the construction of individual houses by dealing with the set-up activities on both national and sub-national coordination.
- The design of the shelter and the materials used should be made of culturally and socially friendly local resources where possible
- The design should foster human interaction between refugees, while taking in consideration the visibility with outdoor environment.
- The repair of existing damaged shelters or the upgrading of initial shelter solutions constructed by the disaster-affected population is prioritized.
- Alternative materials required to provide temporary shelter should be durable, practical and acceptable to the affected population.
- The type of construction, materials used and the sizing and positioning of openings should provide optimal thermal comfort and ventilation.
- Access to water supply sources and sanitation facilities, and the appropriate provision of rainwater harvesting, water storage, drainage and solid waste management, should be secured during and after the construction of shelters.
- Vector control measures can be incorporated into the design and materials selected to minimize health hazards.
- Adequate ventilation should be provided within the shelter design to maintain a healthy internal environment and to limit the risk of transmission of diseases.
- The impact of experimental designs on users should be monitored and assessed. The community participation of the refugee population is recommended in the various design stages.
- To minimize the adverse impact on the environment, disaster-affected households should be settled in environmentally friendly habitats.
- Construction material of refugee's habitats should be made of lightweight and easy to be carried and movable from one place to another.
- Nature in its best form can be simulated in these projects to achieve compatibility between design and the environment.

9. Future Research

To avoid sudden crisis in the future, architects should always search for innovative techniques in architecture, which seek to apply the idea of sustainability in light of the severe shortage of energies and other basic resources. In addition to tackling the potential for reviving the metabolism trend of architecture [7], empowering the sustainable minimalism perspective in disaster relief architecture, and the conclusion of how to design a small self-sustained micro energy unit, the methods of aggregation in horizontal or vertical clusters and other projects and ideas led by Kisho Kurokawa and other pioneers. In this sense, the use of modern technologies, such as three-dimensional printing [1] and simulation programs [8] can be examined in the preliminary design steps of experimental refugee's habitat design projects. Future research may also tackle the scenarios of architecture in the future starting from the Archigram plug-in-city [2] to the 21st century architects' visions about the future to envisage the design for temporary housing in the future.

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