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FULL LENGTH ARTICLE

The post-disaster temporary dwelling: Fundamentals of provision, design and construction

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Abstract Temporary dwellings constitute a crucial step of recovery and reconstruction in the post-disaster aftermath. The importance of temporary dwellings stems from the role they play in incubating people and providing a habitable environment while the outcomes of a disaster are being assessed and then rectified. The main aim of this paper is to set a series of guideline recommendations which can lead the process of successfully providing, designing and constructing temporary dwellings of quality while being sensitive to contextual issues and while aiming for significant cost, efforts and time savings.

Methodology and paper structure: The methodology adopted by this paper is based on the multidisciplinary investigation of the subjects discussed. The paper takes into consideration that the issues under examination are multifaceted while being associated with certain needs and having their own implications and criteria to be successfully achieved. To this end, the paper's methodology elaborates on the discussions made in terms of economic, socio-cultural, ecologic, temporal and technical considerations and circumstances. The research methodology employed in this paper also strives to be comprehensive in the sense of covering a wide range of topics on the qualitative, managerial, contextual and best practices' fronts. The scope of discussions widens up to include basics and general concepts and then narrows down to focus in depth on the investigated subjects.

In employing the adopted methodology of research, the paper commences by a literature review which aims to set the basic terms and concepts. Consecutively, the paper sets the basic foundations to the provision, design and construction of temporary dwellings. The discussion widens in scope to analyze the qualitative aspects related to the management of temporary dwellings. This part constitutes the basic guidelines which support the following discussions made in the paper. As the subjects keep on unfolding, the concept of contextualization is elaborated with the issue of 'sensitivity' to local conditions and circumstances as a prime focus. The paper finally proceeds to analyzing a

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number of important qualitative aspects related to the design and construction of temporary dwellings with a special focus on temporary houses. The discussion is emphasized through examining several examples to clarify the various needs and implications of the qualitative aspects under investigation. The overall research outcome of the paper is expressed in a number of findings and recommendations in correspondence to the paper structure.

Introduction

Temporary dwellings are a common key player in disaster scenarios. The provision and deployment of temporary dwellings in sites are executed after the strike of a disaster during the emergency, reconstruction and rehabilitation phases to incubate the affected people from the onset of a disaster until permanent housing solutions are available. Earlier to this, preparing for the provision and construction of temporary dwellings in similarity to their design process optimally takes place in pre-disaster (pre-event) phases when resources and efforts are allocated in preparation for the outcomes of future disaster events. The main considerations related to these processes are strongly argued to be quality oriented and include for instance materializing the users' requirements into a solid coherent solutions of quality as well as achieving minimum negative environmental impact in all stages. The provision of temporary dwellings is about the prompt readiness and availability of the dwellings to affected people as well as the absence of conflict between the different parties providing the dwellings (represented in the easy distribution of units of similar or at least close standards). On a similar note, the main considerations of the construction process of temporary dwellings include ease of assembly/deployment in sites, affordability and targeting communal participation in the construction process.

All of these considerations relate directly to the overall quality of temporary dwellings. For example, communal participation helps establish a strong identity relationship between the occupants and their new dwellings. Similarly, affordability of the dwellings is a main issue that has to be addressed especially in economically vulnerable disaster communities. To investigate the relationship between the notion of quality and the concept of post-disaster temporary dwellings; the later are first defined and categorized in order to be examined in terms of the qualitative consideration of their provision, design and construction.

Definitions and categorization of temporary dwellings

Temporary dwellings can be defined as structures to incubate people living in communities which have been affected by a disaster (commonly referred to as disaster survivors). A temporary dwelling's settlement is the urban complex resulting from erecting temporary dwellings along with other services (educational, health, etc.) to serve the disaster affected community [1]. The need for temporary dwellings is urgent when disaster survivors cannot live in their previous residences and while the acquisition of new permanent houses is not yet achieved. In a disaster management scheme (typically planned, designed and planned by governments in preparation for a disaster event and its outcomes), the application of temporary dwellings comes in the post–disaster phase simultaneously while the recovery and reconstruction strategies are being implemented to overcome the losses induced by a disaster. Nevertheless, planning for the provision, design and construction of temporary dwellings is ideally executed in the pre-event 'preparedness' phase of efficient disaster management when various resources are being allocated and plans are being prepared to deal with the disaster aftermath. There are two distinct categories of temporary dwellings used after disasters:

(1) Temporary shelter (Fig. 1): This may be a public shelter, refuge at friend's house, a shelter under a plastic tent or any other prefabricated enclosure. Temporary shelters

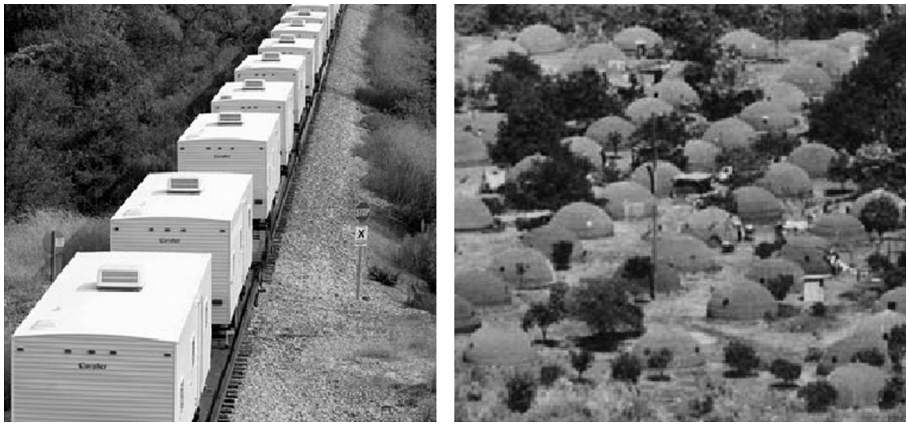

Fig. 1 (Left) Temporary shelters on their way to Louisiana, USA to house families made homeless by hurricane Katrina (Right) Polyurethane igloos used as temporary shelters in Nicaragua in 1976 [4].

are used to incubate people immediately after a disaster. Usually, people stay in emergency shelters for days or weeks until higher quality solutions are provided. People staying in shelters are more likely to stay all day, except for work, school or errands. The need for temporary dwellings is typically ended when the people are provided with temporary houses of higher quality or new permanent homes. Temporary shelters are commonly referred to as 'emergency housing' [2] although the term emergency houses can be found in other contexts as in striving to find affordable housing solutions for the homeless [3].

(2) Temporary house (Fig. 2): This can take the form of a rented apartment or a prefabricated home, among other options. Temporary houses allow the return to normal daily activities, i.e. work, school, cooking at home, shopping, etc. Temporary houses incubate people for longer periods of time (even years) in comparison to temporary shelters. The need for temporary houses can be ended when permanent housing is provided. Nevertheless, temporary houses themselves can evolve into the permanent solutions if a high quality standard of living is provided.

In general, temporary dwellings are a step toward permanent houses in a disaster recovery and reconstruction plan. Permanent houses might be a house that has survived a disaster (or renovated to overcome the disaster impacts) or a totally newly constructed housing solution. Disaster survivors may or may not pass through all of these stages (from a temporary shelter to a permanent house), and many stages may be provided simultaneously to the different sectors of the disaster affected communities. If permanent housing is available quickly enough, people may pass from temporary shelter directly to permanent housing.

Basics of the provision, design and construction of temporary dwellings

The provision of temporary dwellings is portrayed by this paper as the process through which the dwellings (as physical objects) are delivered to their beneficiaries (disaster survivors in need for a dwelling). The design and construction of temporary dwellings are concerned with the physical issues attributed to the dwellings themselves.

Different types of stakeholders are involved in the provision, design and construction of temporary dwellings. Stakeholders are defined as persons, groups, authorities, organizations and bodies that have a 'stake' in the provision, design and construction of temporary dwellings. Stakeholders deal with the various decisions making, planning and management issues related to these three endeavors. Relevant issues include the quantity of dwellings needed per each disaster situation, the form and layout of the dwellings, their dimensions and purpose (whether the designated use is as houses or shelters), available construction materials, ease of construction, time constrictions and the possibility of communal involvement in the construction process amidst a myriad of other issues. Stakeholders' analysis identifies the key participants and defines their relative power, priorities, resources, significance and roles with regard to the provision, design and construction of temporary dwellings on the architectural, planning, economic, socio-cultural, economic, temporal and technical levels [2].

Stakeholders include:

- Disaster relief organizations.
- Governments (national and local), encompassing public entities in a wide range of sectors and roles.
- Community members and citizens' groups.
- Civil society organizations including NGOs (Non Governmental Organizations), civic groups and voluntary associations.
- Private sector (i.e., the business and industrial groups).
- Professional groups, including academic researchers and training organizations, consultation firms, etc.
- Media including newspaper, radio, and television networks.

Conventional 'top-down' approaches to dwellings' provision use official stakeholders' paths such as governments to provide disasters' survivors with their temporary dwellings. This process involves tightly applying and observing formal norms of building standards and land-use management [6]. The approach is called 'top-down' because it is initiated by the governmental authorities and is implemented commonly without the participation of the dwellings' beneficiaries. In the post-disaster context, top-down approaches also emphasize standardization and technology-oriented solutions to get the

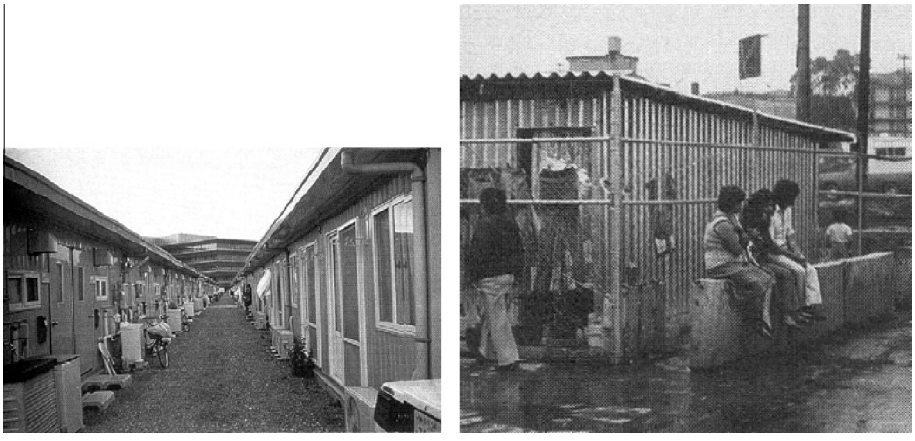

Fig. 2 Temporary houses: (Left) in Japan after the 1995 Kobe earthquake (Right) in Mexico after the 1985 Mexico City earth quake [5].

job done quickly and economically. However, top-down solutions tend to neglect cultural and local conditions as well as users' needs because of the urgency to supply the housing units rapidly.

On the other hand, 'bottom-up' approaches to housing, in which communities and users perform a role in the decision-making and management, are successful in terms of the development of appropriate solutions that respond to the cultural, economic and ecologic conditions and circumstances. Bottom-up approaches can also have the additional benefit of bringing communities into the political and decision making realm. Bottom-up approaches are referred to as such because they are community based approaches and are successful at integrating reconstruction efforts with development opportunities, thus maximizing the potential of investments. They can be implemented also with the aid of Non Governmental Organizations (NGOs) [7].

Differences appear in the objectives of the top-down approaches against those of the bottom-up approaches. Official approaches to post-disaster temporary dwelling usually aim to erect/deploy a large number of units in the shortest possible period of time. On a different note, community-based projects place more importance on sensitivity to local needs, such as using local resources, creating income opportunities for the disaster survivors, reuse of buildings for community purposes and placing maintenance responsibility in the hands of the people rather than the official authorities.

In general, bottom-up approaches are small in terms of the number of units provided through local efforts in comparison to governments' capacity to provide large quantities of units through substantial funding and preparedness. The dwellings' designs, materials and overall quality vary from one solution to the other depending on the specifications outlined by different groups of occupants. Such differences result in some large variations in comfort. On the other hand, government projects are more or less the same, since prefabricated and standardized elements are used to meet the fixed design specifications that are pre-established by the government.

Managing the provision, design and construction of temporary dwellings

This paper uses the term 'management' in reference to any of the processes through which disasters' attributed strategies (including recovery and reconstruction) are planned and implemented. Being an integral aspect of recovery and reconstruction; managing the design, provision and construction endeavors of temporary dwellings is quite related to managing the recovery and reconstruction strategies. Under this managerial umbrella, related actions extend in time between pre-disaster phases up to the full accomplishment of the recovery and reconstruction endeavors in the post-disaster phases. Such actions also vary in nature from planning in preparation for the whole strategy up to actual implementation.

In order to ensure the application of an efficiently successful management scheme of temporary dwellings, a number of basic guidelines can be drawn into a foundation upon which the management process can be based. The guidelines are designated to be wide in scope and are applicable on the macro-scale of the recovery and reconstruction strategies and consecutively on the micro-scale of the temporary dwellings. The following points shed more light on some of the major guidelines.

The uniqueness of each disaster situation

Decisions concerning how to manage the provision, design and construction of temporary dwellings are much influenced by the nature of the disaster, country status on the various fronts, local conditions and circumstances, level of urbanization and cultural values present in each particular disaster case. All of this surely poses question concerning how governments use the available resources and weighs the concerns of speed versus quality.

Engaging and supporting communities

Disaster affected communities should be ideally involved and supported by the joint strategy of government and humanitarian agencies. The main aim would be to fairly and equitably respond to the varying needs of different groups. This is optimally achieved while paying special attention to those who are most vulnerable while addressing grievances and targeting an accountable implementation.

Prompt engagement in the reconstruction process

Generally speaking, prompt investments in safe reconstruction are often an effective stimulus for recovery. Rehabilitation of a certain disaster affected community by providing temporary dwelling solutions is commonly as important as providing emergency relief for disasters' survivors. Support to reconstruction (including temporary dwellings) should be encouraged to begin immediately at the soonest disaster aftermath occasion and not postponed to later phases.

Prioritization

The minimum aspiration for the recovery and reconstruction objectives would be returning a disaster affected community to its status before the disaster while aiming to reduce vulnerability to future disasters. Nevertheless, this is not always achievable in reality. Resources and capacities available can impede a pre-disaster state from being rebuilt like-for-like. To this end, a successful management would agree to the concept of prioritization while allocating resources to the most urgent recovery and reconstruction needs.

Efficient coordination

All efforts exerted by stakeholders in the provision, design and construction of temporary dwellings should be well coordinated within the general aim of agreeing upon the methodologies and technicalities of applying the management strategies. This is a crucial guideline in order to avoid duplication of efforts, financial losses and time wasting.

Relocating vs. rehabilitating communities

Relocating a disaster affected community to a 'safer' location is not always an economically and culturally feasible option. Relocation typically involves considerable consultation and participation throughout the process as well as high levels of funding. A more sensitive alternative is the rehabilitation of a disaster affected community through reconstruction and recovery yet in the same location as prior to the disaster. The later alternative takes into consideration that communities (especially vulnerable ones) might be extremely location-dependent and can be much attached to their original settlements for economic and socio-cultural reasons. Rehabilitation though recovery and reconstruction in the same location (as prior to a disaster) can prove itself to be a cheaper and less tiresome process in comparison to relocation. Nevertheless, special attention should be paid to a number of considerations and circumstance; on top of which is the vulnerability to future disasters.

Contextualization and the management of post-disaster temporary dwellings

Taking into consideration that each disaster situation is unique, the management of temporary dwellings is encouraged to be case- by-case sensitive. In other words, the provision, design and construction of temporary dwellings are to be weighed against the context of the disaster. The term 'context' is used in this discussion in reference to the circumstances and conditions concerning a disaster affected community as well as the disaster itself. Such considerations and circumstances are plenty in number while varying in genre to include the nature of the disaster, (type, magnitude, expected and actual losses, etc.), socio-cultural and ecologic conditions, available funds for reconstruction and recovery, the economic conditions and characteristics of the disaster affected community (types of jobs, annual income per capita), time constraints for the recovery and reconstruction process, etc.

Grasping the entire picture of all these contextual circumstances and considerations is a gigantic endeavor (yet quite crucial) on the route of managing recovery and reconstruction strategies. Moreover, the picture has to be grasped in light of the particularity of each disaster event.

In order to give the discussion a more practical sense, the paper focuses on one of the major contextual issues affecting the provision, design and construction of temporary dwellings; the type of disaster. The main goal of this discussion is to depict how a single type of disasters (floods in this case) can trigger different recovery, reconstruction and temporary dwelling management approaches due to the influences and interactions of different contextual issues.

Post-disaster constructions (including temporary dwellings and permanent houses) are provided after a hazard hits a certain place. The possibility that further disasters can occur in this particular place renders it a 'disaster prone area'. One approach aiming to reduce the probability of disaster attributed losses would be to deploy the post-disaster constructions in 'safer' (non-disaster prone) areas while relocating the disaster affected community to settlements in these new areas. This can be considered as an aspect of disaster 'mitigation'. The logic behind the concept of mitigation in general is to reduce the probabilities of subjecting the communities and constructions to a particular hazard within the general scope of reducing losses to humans, the built environment or any other forms of developments[8]. Disaster mitigation can be achieved through various measures applicable on different planning levels (from the architectural to the regional) and includes for example the concept of relocation. Nevertheless, relocating disaster survivors along with their post-disaster constructions to a non- disaster prone area is not always an achievable endeavor. In regard to temporary houses, people pass a considerable amount of time residing in these houses while attempting to (or actually do) resume their normal lives. If the new location for post-disaster houses is not equipped for (or does not have the potentials of) living, then this particular new location is anything but convenient. To this end, post-disaster temporary houses are commonly found to be deployed in locations near the original disaster affected areas; the thing which in turn makes the houses disaster prone as was the case with the former constructions originally located in these areas prior to the disaster event.

In response to this, disaster events are encouraged to be seen as unique opportunities to improve pre-event social, economic and environmental conditions through the incorporation of hazard mitigation strategies without the excessive need of relocation. The ability to incorporate hazard mitigation principles in post-disaster recovery and reconstruction strategies (in the same pre-event locations) requires the involvement of both technical and political leaderships. The main goal would be to confront forces that attempt to maintain the unfair already existent conditions (economic, socio-cultural, ecologic), rebuild damaged communities to their pre-disaster condition without incorporating hazard mitigation techniques, or profit from disasters at the expense of the community.

The following example of the City of Charlotte and Mecklenburg County in North Carolina USA demonstrates the benefits of disaster mitigation strategies in responding to the contextual circumstances and considerations attributed to disasters. The paper focuses on this particular example as it demonstrates a number of the key issues relating to the relationship between the context of disasters and the approaches to manage post-disaster constructions (including temporary dwellings).

The City of Charlotte and the Mecklenburg County were subjected to major flood event in 1995. In response, the city and county decided to adopt a post-disaster mitigation strategy gunning for reduced future flood-related losses. The strategy recognized that the homes built by local developers to existing city and county floodplain management standards had flooded repeatedly in the past. In response, the city and county created a special panel consisting of various expertises to remedy the existent poor flood water management schemes. The panel created a plan to increase the volumetric capacity of the flood watersheds available in the city and county through converting some of the land areas vulnerable to flooding into watersheds themselves. This necessitated at some points purchasing lands from owners, providing relocation alternatives and applying extensive reconstruction (digging and casing) processes to convert these lands into the watersheds[9].

From discussing this example, it is deducible that the main aim of the adopted plan is to mitigate the effects of a flood disaster through converting the city and county on the regional

Fig. 3 The construction practices advocated by the NGO 'practical action' and targeting flood resilient houses in Bangladesh (http://practicalaction.org/practical-action-bangladesh-1: accessed on 17th of April 2013).

planning level from a flood- prone area to a 'safer' one. The plan clearly recognizes that a disaster is only a disaster when a hazardous event (whether natural or man-made) has the probability of causing losses in humans and assets. Mitigating the probability of future floods by increasing the watershed areas allows the safe deployment of post-disaster reconstructions (including temporary houses) in the city and county. This can prove to be of great importance as it sustains further living in the city and county without extensive needs for relocation. To this end, the damages attributed to the disaster are immensely reduced.

The example features specific management approaches in order to integrate hazard mitigation strategies in the recovery plan. This includes identifying organizations responsible for leading the recovery efforts, applying land use practices and investing in large processes of regional planning (and accordingly reconstruction endeavors). All of these managerial acts necessitate a high level of organization on the national level and are attributed to considerable amounts of funds. Despite being of success in relevance to the contextual considerations and circumstances of one country (the USA being a world leader on the economic and organizational fronts), the mitigation approach on the regional planning level is not as successfully applicable in other contexts of lesser fortune.

Taking Bangladesh as an example, flooding annually kills hundreds of people, damages million of homes, and wipes out millions of hectares of crops. The most affected are those who live in the Charlands of the delta where the Himalayan waters flow toward the Bay of Bengal. Yet instead of gunning for disaster mitigation strategies on the regional planning level, several NGOs work with local communities in Bangladesh to develop simple and affordable flood-resistant housing [10]. A major reason behind this is that seeking mitigation on the design and construction level of post-disaster temporary dwellings can prove itself to be quite useful in scenarios where the contextual conditions and circumstances would not allow a more regional approach. The final target is improving the disaster resilience capacity of the houses. This can be also considered as an aspect of mitigation since the logic employed aims to reduce the probability of a hazardous event causing losses in humans and assets.

One of the most denoted trials on this route is carried out by the NGO named 'practical action' in collaboration with local communities in Bangladesh. The paper focuses on this particular example as it reflects a clear sensitivity to the contextual circumstances and considerations represented in the weak economic indicators of the country and lack of organizational tendencies on the national level. According to the official website of the NGO (http://practicalaction.org/practical-action-bangladesh-1), the NGO advocates the use of locally abundant bamboo poles as the structural elements (skeleton) of houses. The poles are fixed in concrete bases and strengthened with metal tie rods. Walls are made from locally available jute and are cheap and easy to replace. Bracings and fastenings bind the walls firmly to the house skeleton through a network of holes and notches. A plinth raises the house up further above the surrounding land to avoid flooding the house floor with water. The plinth is made from soil, a little cement and some pieces of stone and brick and is strongly high enough to last through repeated floods (unlike the traditional earthen floors that simply wash away).Around the house, locally available water-thirsty plants such as bamboo, banana, hogla and kolmi are cultivated in order to 'drink up' flood water and hold onto the soil while helping the whole homestead stay intact. A separate area is adjoined to the house to shelter the animals (poultry and live stock) crucial to the family's welfare (Fig. 3).

From discussing this example, it is deducible that applying the concept of mitigation through design and construction practices can be shaped in response to certain contextual issues in order to develop temporary dwellings of quality. Evidence of contextual sensitivity is apparent in the use of simple construction practices while taking into consideration the community's technical knowledge level. In addition, each design and construction practice advocated by the NGO is sensitive to the issues of local poverty and is derived in relation to materials that are readily available and highly cost effective. Simple additions such as water-thirsty plants that are widely available for use by the local community also represent an ingenious way of achieving flood-resistant constructions through simplified, cheap and sustainable methods.

Preload to the qualitative aspects of temporary houses

From analyzing the definitions of temporary shelters and temporary houses, it is deducible that the concept of 'quality living' is a main issue. Temporary houses typically exhibit higher quality aspects than temporary shelters. One reason behind this is because temporary houses are typically designed to incubate people for a longer period of time in comparison to shelters. Another reason is that temporary houses can be originally designed and planned (during the preparedness phase of a disaster planning) to form a nucleus for permanent housing settlements if certain qualitative conditions and circumstances are available.

The qualitative aspects related to temporary houses are argued to be multifaceted while interacting together and influencing the needs and outcomes of one another. For instance,

encouraging the public participation in the construction process of temporary dwellings can have the desirable effect of speeding up the construction process and reducing attributed costs. Nevertheless, other qualitative characteristics of the house (such as robustness and durability) can be redundant if the participants have a low knowledge level regarding the basics of structural integrity. The following sections of this paper analytically depict a number of the main qualitative aspects related to temporary houses. This is carried out while stressing the need to optimize the final outcome of these aspects by weighing them against one another as well as against different issues on the economic, socio-cultural, ecologic, temporal and structural integrity fronts. Despite that temporary housing solutions are the main subject under study, examples of temporary shelters which exhibit qualitative features (as well as examples of temporary houses which are not related to disasters) are made in due course. This is based on the argument that any housing solution is worth analyzing and discussing as long as it contributes to the general goal of setting a way to a better quality living.

The qualitative aspect of fast and easy construction

In general, temporary houses require fast erection. The process can be speeded up through various methods. For, instance, using onsite available or produced materials surely saves the transportation time of products and materials from far locations. Also of considerable importance is the occupants' participation in the construction process. Besides saving time (which is crucial in the provision of post-disaster dwellings), the participation of disaster survivors in the construction process surely strengthens the communal collaboration sense. Another important method is the use of prefabricated structures and building components which require simple assembly (and thus short time) to be assembled in sites .Each of these methods has its own needs and resulting outcomes. The following discussion aims to shed more light on the subject by analyzing a number of selected examples. The main criterion behind the choice of these particular examples is their relevance to the qualitative aspect of speeding up the construction process.

The use of onsite available materials

A commendable milestone on this track is the 'superadobe' technique conceived by the Iranian architect Nader Khalili and featured on his official website (http://calearth.org/archmag/ArchMag.htm). Khalili proposed dome shaped dwellings that are constructed mainly of onsite and abundantly available materials (Fig. 4). Standard polypropylene sandbags (14–18 in in diameter and up to a mile in length) are filled with dirt, sand, or clay and then wound in circular or spiraling forms and held in place with barbed wire in-between each layer.

After an earthquake had struck Kashmir and Pakistan on October 2005, there was a bottom-up opportunity for the community to play a major role through the 'superadobe' shelters in the reconstruction efforts. Khalili design team (in collaboration with local authorities) organized training sessions in order to practically demonstrate the construction process to the local community. The sessions proved to be a success as knowledge of the construction method would spread among the community and building of the housing units can be done independently. The 'superadobe' dome shelter, up to 16 feet wide, can be built in a single day by a family of four.

In the 'superadobe' example, the use of dirt, sand and clay (materials available onsite) as the main construction material has its sure impact on reducing the time needed for constructing the 'superadobe' houses. The need for educating the locals about the construction technique is also coverable. The use of natural materials is also considered as an environmentally preferable practice as it reduces that need for high energy consuming products and reduces the energy loss and waste emission attributed to transporting materials form far locations.

Yet the question that remains at this point is concerned with the overall qualitative outcome of the housing solution.

In resemblance to permanent houses, temporary dwellings aim to acquire high quality characteristics. Despite being temporary (are to be deployed in a certain location for a limited period of time), aspects like durability and ability to resist harsh environmental factors are fundamental to the design process. In the 'superadobe' dwellings, the earth itself -as a building material- provides insulation and fireproofing. The house enclosure being laid down in circles with barbed wire

Fig. 4 The 'superadobe' houses construction sequence (http://calearth.org/building-designs/emergency-sandbag-shelter.htm: accessed on 20th of April 2013).

Fig. 5 The 'superadobe' domes with their streamlined form (http://calearth.org/building-designs/emergency-sandbag-shelter.htm accessed on 20th of April 2013).

in between the layers provides earthquake resistance. The resulting units can last decades if cement is added to the soil mix or if the exterior is plastered. In 1991, Khalili's California Institute of 'Earth Art and Architecture' tested the architect's dome prototypes and found them to pass seismic tests to meet California's stringent building codes (http://calearth.org/archmag/ArchMag.htm). The streamlined shape of the dome (Fig. 5) also adds to its ability to resist wind turbulences. The choice of the streamlined shape is also successful with respect to minimization of exposure to environmental conditions (especially solar radiation). The dome shape has the extra benefit of enclosing a large volume while reducing the amounts of construction materials.

The use of prefabricated components

The use of 'closed prefabrication systems' for the provision of post-disaster temporary houses is commonly negatively criticized. The term 'closed prefabrication systems' is used by this paper in reference to the process of industrially fabricating houses into complete and non-modifiable configurations and forms and then transporting these houses to their construction sites. A major disadvantage of closed prefabrication systems is their inflexibility to meet the varying needs of disaster survivors. Prefabricated houses can also result in expensive solutions and do not commonly involve the participation of the local community in the construction process; the thing which would alienate more the housing solutions and increase the level of detest by their occupants.

In light of this, a more successful approach would be the implementation of 'open prefabrication systems' where standardized components are being provided in factories and transferred to the construction sites of temporary dwellings. Open prefabrication systems allow various possibilities of assembly into indifferent housing forms and configurations. The coupling of light prefabricated components with local initiatives by the disaster affected community proves itself to be economically advantageous (cheaper than prefabricated housing solutions) while also being socially and culturally acceptable.

In order to shed more light on the subject, the paper compares the different qualitative aspects of an example of closed system prefabricated houses to those of an open system prefabricated ones. The common ground for both of these examples is the use of prefabricated systems in construction, the short time needed for the deployment in sites as well as being located in the same country; Japan. Unifying the location of the two house examples decreases the number of variables affecting the development of the solutions. This is important because the main issue of the comparison is the qualitative aspects.

To start with, the 'Ex-container' housing solution represents an effort to address the displaced populations following widespread earthquake and tsunami devastation still unfolding in Japan. The 'Ex-container' idea depends on the use of container homes (closed prefabricated houses) that are fully constructed and assembled in factories and then transported to the designated sites (Fig. 6). The 'Ex-container' is not a pure shipping container. The design solution developed by Yasutaka Yoshimura Architects design firm in Japan

Fig. 6 (Left) The complete assembly of the 'EX-container' in factories. (Middle) The deployment of the 'Ex –container' in sites. (Right) An interior view of the 'Ex-container' (http://exc.ysmr.com/container_e/: accessed on the 21st of April 2013).

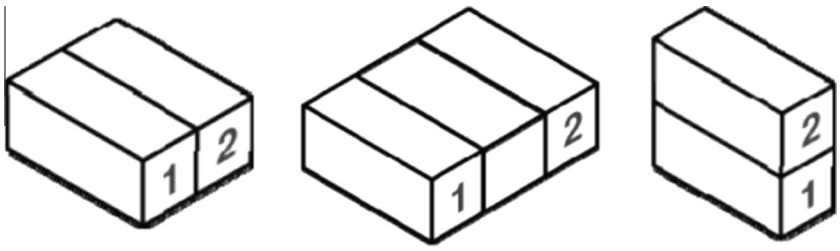

Fig. 7 The different assembly configurations of the 'Ex-container' (http://exc.ysmr.com/container_e/: accessed on the 21st of April 2013).

(http://exc.ysmr.com/container_e/): accessed on the 21st of April 2013) utilizes the format of shipping containers into housing solutions. Pure shipping containers cannot be used as buildings in Japan. Instead, the steel frames of the shipping container are redesigned by reducing unnecessary parts to fit the housing regulations in the country. This also has the extra benefit of attempting to reduce the cost of the units. The 'Ex-container', being totally pre-assembled in factories decreases the in situ work need. In addition, having the dimensions of a standard shipping container, the 'Ex-container' is easy to transport by air and sea to designated sites.

The 'Ex-container' can be assembled in different configurations (Fig. 7). The units can be adjoined horizontally by using two 20 feet container side by side. This results in an approximate area of 28 square meters including a bathroom, Kitchen and living room. The units can also be grouped horizontally with an interval between them resulting in a larger surface area of- approximately 50–60 square meters. In smaller sites where areas are significantly tight, the units are assembled vertically on top of one another using two-storeyed housing. The targeted price of two units assembled horizontally is 3 million yen (approx. US$36,000). With the interval gap added between the two units, the target price increases to 5 million yen (approx. US$60,000). If the units are assembled vertically, the targeted price is 4 million yen (approx. US$48,000).

Despite its advantages (including the trial to reduce the cost by eliminating unneeded parts), the 'Ex-container' still demonstrates a certain inflexibility regarding its internal layout. Extensions and modifications to the original units are hard to apply with the 'Ex-container'. Besides, the units are closed system prefabricated in factories and do not involve the participation of the house beneficiaries neither in the design nor construction processes. This reduces the interaction of the house occupants with the housing solutions and reduces the probabilities of applying modifications and interventions to the interior design of the units.

In contrast to the shortcomings attributed to closed prefabricated systems, the use of open prefabricated systems can result in housing solutions that are cheap, easy to construct, modifiable and involve the participation of the community. The following example shed more light on such benefits.

In the design of the temporary 'blog house' by Shigeru Ban, considerations are taken to make this housing solution cheep, easy to assemble and insulated against both summer and winter conditions without the need of sophisticated craftsmanship [11]. The open prefabrication system employed in the house is

Fig. 8 (Above) The easy and fast assembly of the 'blog house' cardboard tubes. (Below) The roof tenting material and the operable hatch of the 'blog house' [11].

based on the use of light-weight cardboard tubes (4.25 inch diameter and 16 inch thick) that are made in factories and transported to the construction sites in order to be assembled into houses of varying forms and configurations. The tubes are simply assembled by nuts and bolts. The foundation of the 'blog house' is made from crates loaded with sandbags. A fabric tenting material is used for the roof. The house also features an operable roof hatch which is opened in summer to allow air to circulate and closed in winter to retain warm air (Fig. 8). For insulation, waterproof sponge tape backed with adhesive is sandwiched between the paper tubes of the walls. Another remarkable feature of this housing solution is the esthetic sense. The use of warm colored and wood resembling materials on the outdoor and indoor of the units is strongly argued to give a 'homey' sense. Besides, when the houses are deployed together in the site, the 6 feet wide space between houses is usable as a common area.

The 'blog house', due its fabric roof, does not feature the possibility of vertical grouping as is the case with the 'Ex-container'. Nevertheless, other critical advantages are featured in the 'blog house' design. For instance, the construction of the house (being based on prefabricated components to be assembled) can encourage the participation of the disaster affected community in the process. Resolving to the use of small building components like the cardboard tubes (instead of offering a fully developed and non-modifiable housing solution) also allows the house occupants to remodel their units as required. Extensions to the original rectangular design of the 'bog house' units can be easily applied. This reinforces the sense of belonging to the architectural solution and helps the occupants develop an identity for their own; two of the major criteria of a qualitatively successful housing design. Moreover, and in contrast to the relatively higher cost of the 'Ex-container', the cost of materials for one 17 square meters blog house unit (in 2001) is below US$ 2500. The units are easy to mantle and dismantle (by a group of four people in almost 6 h) while the materials can be easily recycled.

Yet, in the air of fair comparison, it should be also mentioned that the 'Ex-container' can be evaluated to be more robust and durable than the 'blog house'; the former being made form steel and the later form cardboard tubes. Questions relating to the durability and robustness of temporary dwellings are directly related to the targeted lifetime of the houses. In general, temporary houses are designed to cover the period required to construct permanent homes after disasters. However this issue has to be considered carefully as it has its sure impact on the types of the materials used, the overall environmental impact assessment of the houses and the decisions taken to convert temporary houses into permanent ones.

The qualitative aspect of communal participation

The participation of a disaster affected community as a stakeholder in the provision, design and construction of temporary houses can help create a sense of communal interaction after a disaster. Moreover, communal participation can reinforce the sense of responsibility in regard to the maintenance of the dwellings and can have a desirable impact on speeding up the construction process. The following example helps shed more light on some of the benefits attributed to communal participation in post-disaster housing schemes.

After the 1999 earthquake In Turkey, the disaster affected community was not involved in the construction process of most of the top-down housing solutions. The lack of participation caused low maintenance responsibility and apparent carelessness regarding the status of the houses after the occupants have evacuated the temporary houses. In contrast to this, a cooperation of IBC (International Blue Crescent) and CRS (Catholic Relief Service) resulted in a housing scheme known as 'Beyciler' social housing project [12]. The 'Beyciler' social housing project had a cooperative bottom-up provision approach through which the houses were constructed by NGOs but the interior of houses would be finished by the house beneficiaries. The occupants had a chance to enlarge the houses through the addition of extra spaces yet within regulations. Families also had the chance to induce changes on the interior design level and thus demonstrated willingness to participate in the construction of their own and even other people's houses (Fig. 9). The modifications and choices practiced by the occupants included:

- Joining the living room and children room together into a larger living room.
- Selection of toilet style (either European or Turkish style).
- Selection of interior finishing materials.

Allowing such modifications and choices reflects the importance of occupants' participation in the construction process as in:

Fig. 9 Public participation in the construction process of 'Beyciler' Social Housing Project in Turkey (http://www.grifumontreal.ca/pages/ARSLAN_%20Hakan.pdf: accessed on 18 h of April 2013).

- Increasing the sense of belonging to the housing solution
- Reinforcing the sense of identity and giving the house a homey feeling
- Allowing modifications according to varying needs
- Decreasing the construction time and attributed costs

Relevant to the subject of communal participation in post-disaster housing schemes is the role of vulnerable groups. By vulnerable groups, this paper refers to those who are most affected by a disaster on the different aspects of their living. Vulnerable groups of disaster affected communities are commonly found to be quite attached to their original settlements economically and culturally. Consecutively, vulnerable groups are commonly extremely aware of the most appropriate and rapid routes to recovery .The desire of such groups to embark immediately on recovery and reconstruction in the disaster aftermath can be a matter of life and death especially in the absence of other alternatives to sustain different aspects of living (working, residence, entertainment, etc.). Generally speaking, the greatest efforts are exerted by those most affected

The participation of vulnerable groups in the recovery and reconstruction after a disaster (especially in temporary housing schemes) can result favorably in the decentralization of decision making. Local democratization is further enhanced by such an involvement. Besides, spreading the process of decision-making among a larger percentage of the community is a step toward social equity, fairness and reduction of excluding certain groups on the basis of age, gender and economic conditions.

Vulnerable groups (being economically and culturally versed in their original location prior to a disaster) can already have strong community ties, social cohesion and communal values. Such positive attributes can be utilized to speed up the recovery and construction endeavors including temporary dwellings. In addition, vulnerable groups which, over the years, have already developed technical solutions well adapted to their own context can exploit local knowhow and traditional solutions while reducing the need for 'imported' solutions. This can have a positive impact on reducing the funds and temporal needs for recovery and reconstruction.

All of such benefits strengthen the argument that taking action at the community level is important and useful. Nevertheless, and in practice, this is not entirely accurate. For instance, the success of the community participation in the construction process of temporary houses is influenced by several criteria including:

- The know-how of the construction techniques.
- The overall resultant quality expected from the community's participation.
- Compliance of modifications made by the house occupants to building regulations.
- Correct coordination of efforts.
- etc.

To this end, the subject of community participation has to be weighed carefully in terms of its expected benefits against the criteria of its successful implementation; otherwise, the final outcomes would be anything but desirable and fruitful.

The qualitative aspect of affordability

Temporary dwellings should optimally strive to be affordable. Nevertheless, affordability, as a concept, reflects a clear sense of relativity. For instance, in the examples of the 'Ex-container' and 'blog house' discussed previously in this paper, the lowest price for an 'Ex-container' housing configuration (26 square meters) is around US$ 36,000 (in 2009) while a blog house of the same area would cost around US$ 4000 (in 2001). The two housing solutions are developed in Japan where the Gross National Income (GNI) per capita in 2011, is around US$ 44,900 [13]. Based on these figures, the two housing solutions (although the 'Ex-container' is substantially higher in price) are argued to be relatively affordable for a Japanese individual. This might not be the not the casein underdeveloped countries, for instance, Egypt, where the GNI per capita in 2011 is calculated to be 6120 US$.

From this discussion, it is deducible that the concept of affordability is interpreted in relativity to the economic indicators of the location where affordability is being questioned in the first place. Accordingly, when post-disaster houses are to be provided, designed and constructed, special attention is to be paid to the economic contextual circumstances of the disaster affected community.

Yet, and despite of this need to contextualize the issue of affordability, several general strategies can be adopted in order to ensure the affordability of temporary houses. The generality of these strategies stems from the hypothesis that a balance should be found between the cost of temporary houses and their overall qualities. The fact that the per capita income in some countries would allow the acquisition, installment or even rental of some houses does not negate the argument the governments should be involved in the provision of temporary houses and that 'saving for a rainy day' even in developed countries is a common practice by citizens. The high income per capita in some countries does not also necessarily have to hinder the community's participation in the post-disaster housing schemes. To this end, the adoption of affordability strategies is advocated to be applicable in general and does not only designate underdeveloped countries where the 'rainy day' is more likely to come. Following is a number of the major affordability strategies portrayed in terms of goals and implications.

Subsidy and self-help

Subsidy involves the payment of grants to cover a part or all of the costs of housing. As a funding strategy, subsidy is commonly executed by official assisting groups (such as governmental agencies) in order to render the housing solutions more affordable to the community. To this end, subsidy often represents a top-down approach of stakeholders' participation in post-disaster housing schemes.

Subsidy through outright cash grants can be most effective on the short term. Yet on the long term, the strategy can result in a dependency relationship between disaster survivors and assisting groups; the thing which would undermine the community's capacity to stand back on its feet and participate in the recovery and reconstruction after a disaster. Further Long term shortcomings of subsidy reveal themselves in the long periods of time needed for paper works (bureaucracy)

and lack of agreement about the minimum acceptable level of service to be provided to the houses' beneficiaries.

In order to help overcome these shortcomings, the strategy of self-help is widely encouraged to be incorporated in subsidy strategies. Self-help refers to the potential for self-building. Advocating self-help is based on the argument that it is far more advantageous for both the individual and the community to participate in the development and implementation of post-disaster housing schemes. When applied with subsidy, the strategy of self-help fights against providing the community with completely finished houses, infrastructures and services. Instead, the disaster affected community, receiving money through subsidy, is invited to participate in making the decisions concerning the built environment. This can prove to be of success when the participation of the community in the decision making processes is organized and controlled to ensure the maximum fruition of the subsidy grants.

Simplification vs. Reduction of quality

The concept of simplification refers to the stripping of any superfluous details such as decorations, outdoor of temporary houses and consecutively gun for affordability. Yet again, the question that poses itself at this point is concerned with the overall quality of the housing solution after simplification and removal of details. Even if the basic amenities are still available, giving the house 'a homey' feeling is a common goal in housing solutions and this might not be achievable by reducing details beyond a certain limit.

The evolvement of temporary houses into permanent housing schemes

The tendency of temporary houses to evolve into permanent ones is based on several arguments. To start with, temporary houses are optimally encouraged to be seen as more than discrete 'products'. A temporary house is strongly argued to be a cultural artifact that has particular meaning for the community within which it is located. To this end, temporary houses are developed with the concept of quality optimally in mind. For instance, and in comparison to temporary shelters, temporary houses are larger in area, more durable and esthetically pleasing and contain more various interior subdivisions. All of this approximates successful temporary housing solutions to permanent ones. In addition to this, people usually pass longer periods of time in temporary houses in comparison to temporary shelters. Such long periods commonly strengthen the sense of belonging to the housing solution and render the evacuation of the houses a difficult process. Moreover, while staying in their temporary houses, people resume their lives (or at least attempt to do so). The different aspects of living (working, entertainment, commercial activities and even the factor of habit) deepen to a further extent the relationship between a temporary house and its occupants. This effect is much profound when the temporary house has been originally provided through bottom -up approaches which allow the house occupants to interact more with their houses.

All of these arguments increase the tendency of temporary houses' evolvement into permanent ones. This can have a number of desirable outcomes. For a starter, this evolvement ensures the maximum fruition of the initial investments. This is simply because there is no need for a surplus flux of investment to build other permanent homes. The evolvement of temporary houses into permanent ones also eliminates the costs associated with the removal of the temporary houses and relocating their occupants. On a similar note, temporary houses can be located in areas already planned for future development within official governmental schemes. In this scenario, the temporary housing schemes represent a nucleus of already charted permanent developments. This would definitely decrease the financial burdens on the government and eventually result in more affordable developments.

The following example helps shed more light on such benefits. The paper focuses on this example in particular as it demonstrates a certain flexibility in the decision making process which recognizes that temporary houses often tend to evolve into permanent ones. With this tendency in mind, designing post-disaster housing solutions can be successfully developed while gunning for sustainability, disaster resilience and affordability; the thing which would 'smoothen' the evolvement of the temporary houses into permanent ones.

In August 2005, hurricane Katrina devastated the US Gulf Coast while inflicting major damage on housing, commercial property and infrastructure. In response, the Federal Emergency Management Agency (FEMA) provided the disaster survivors with temporary shelters, (drawing from the FEMA existing inventory of temporary trailers along with the purchase of additional travel trailers) [14]. The FEMA trailers were a mix of used small trailers (18.5 square meters in area), new trailers (37 square meters in area) and even larger mobile homes. The trailers were equipped with wheels for ease of movement to designated sites (Fig. 10). The newly manufactured trailers were made using the least expensive and most readily available materials and methods in order to meet the massive housing demand after the disaster. The fabrication of the units was done hastily in factories and the trailers were found to be unsustainable when in use due to their relative expense, short life expectancy as well as providing a poor indoor health environment due to the low quality materials used in the fabrication of the units [15].

Fig. 10 Different trailer types provided by FEMA as temporary shelters to hurricane Katrina affected communities [14].

Fig. 11 The 'Katrina Cottage' temporary house (http://www.mariannecusato.com/katrina-cottages.html).

In addition to this, the travel trailers (as temporary shelters) were originally designated to be used for a limit of 18 months, yet 2 years after the hurricane, 60,000 people were still found living in the trailers in the states of Louisiana and Mississippi [16]. This is quite comprehensible as people resume their lives while residing in post-disaster temporary dwellings and thus become attached to the dwellings even if of poor quality.

All of this rendered the FEMA travel trailers dissatisfactory in terms of quality to their occupants and consecutively inconvenient as a solution to the government [17]. In response, and recognizing that evolving from the temporary to the permanent is an ongoing practice, local governments started searching for temporary housing solutions that are able to evolve into permanent houses of quality [18]. The objectives targeted in these solutions were concerned with affordability, sustainability, ability to mitigate damage from future storms and being appropriate to regional culture and climate conditions.

A successful housing solution presented itself in the design developed by architect Marianne Cusato and known as the 'Katrina cottage' (Fig. 11). The first Katrina cottage designed was set for an area of 27.8 square meters while gunning for a size relevant to the FEMA trailers [19]. A Katrina cottage house is assembled using cheap, durable and light prefabricated timber panels specially designed for hurricane conditions. The house is able to withstand high wind-loads and excessive moisture without incurring damage or destruction. The roof is covered in tin sheets to protect against rain. Being made from relatively cheap (yet durable) materials, the cost of the 'Katrina Cottage' in 2008 was less than 42,000 US$ including bathroom, kitchen and a front porch. Taking into consideration that the house is to be used as a permanent residence, the target price of the Katrina cottage is strongly argued to be affordable.

Findings and recommendations

Managing the provision, design and construction of temporary dwellings

The design, construction and provision of temporary dwellings of quality can be guided through a number of recommendations which extend on the socio-cultural, economic, ecologic and temporal fronts. Such recommendations include:

- Rapid availability: Most importantly, temporary dwellings should be rapidly available for the affected population. For this to happen, the financial and organizational resources must be in place before the disaster occurs to swiftly instigate the temporary housing program, and a supply of units must be available.
- Dependence on local suppliers and/or local resources: the temporary dwelling provision program can promote national or local manufacturers and suppliers as well as the economy by using domestically produced products, services and labor.
- Compatibility with local living standards in terms of comfort, services and location: Living standards in one disaster-affected area are different than the living standards in another; therefore the design, services and locations used for the temporary dwelling should reflect local living standards rather than living standards of the donor country.
- Design for the length of time the dwelling is needed or an efficient long-term plan for the units: Commonly, temporary shelters are not to last (or in other words are not intended to be used) longer than they are needed as temporary dwellings. On the other hand, temporary houses can evolve into permanent solutions. In this case, end-occupancy management should be designed and implemented to allow residents who are in need of housing to stay in the temporary houses if the quality of living conditions is suitable.
- Easy and non polluting removal of temporary dwellings: Land leases for temporary dwelling projects can stipulate that the sites must be cleaned and returned to their original condition before the end of the lease. Infrastructure, units and foundations that are simple to remove will likely leave the site less littered.

Contextualization and the management of post-disaster temporary dwellings

This paper advocates that contextualization is a primary thread that should ideally run through each disaster recovery

and reconstruction strategy. As demonstrated through the discussions, the particularity of each disaster situation would dictate certain best practices to be applied while being 'sensitive' to the local context of the disaster affected community. Nevertheless, this paper also argues that the concept of contextualization, represented in the impacts of circumstances and conditions, is attributed to a number of general best practices. Such practices can help shape the response after a disaster in a manner that is common for all disaster situations while targeting efficient and implementable recovery and reconstruction strategies. Following is a brief description of some of the most important general practices:

- When communities are impacted and officials are scrambling to address basic needs, the development of recovery and reconstruction plans after a disaster might not be an achievable task due to time constraints and inability to coordinate efforts in the mayhem following a disaster. To this end, developing the recovery and reconstruction strategies in the phases prior to a disaster is a much recommended practice. Pre-event planning allows for the formulation of policy recommendations in anticipation to disasters while being based on good fact bases and targeting the involvement of a wide range of stakeholders.
- Disaster recovery and reconstruction plans created after an event can still succeed under the right conditions. The ability to allocate resources and coordinate efforts after a disaster can represent a window of opportunity in convincing stakeholders to reach an agreement on how to build safer and more sustainable communities.
- Pre-event planning (and also post-disaster planning endeavors) should ideally recognize that collaborative planning strengthens the quality of policies adopted and decisions made. Significant cost and time wastes can result from non-cooperation between the various stake holders involved in the management of temporary dwellings. To this end, conflicting organizational objectives must be aligned in order to achieve long-term sustainable solutions. Collaborative planning also has a sure impact on establishing and regularly updating the fact base of the recovery and reconstruction plans. This is based on the argument that hazards are dynamic and changes in human settlement patterns can further alter a community's hazard vulnerability. The ability to collect and analyze data through collaborative planning results in the synthesis of sound recovery and reconstruction plans. This is ideally carried out while regularly evaluating and amending the plans fact base in order to respond to the continuously changing contextual circumstances and conditions in one location as well as to the contextual differences between one location and the other.
- The developed strategies for recovery and reconstruction should encourage self-help as a part of the disaster management strategies. Emphasizing the role of self-help and communal participation can develop an enduring ability to recover from future disasters.
- The involvement of technical expertise and political leadership affects to a great extent the ability to induce changes after a disaster in a certain context. Technical expertise, including planners, provides fact-based information that results in sound decision making and policies. For instance, land use planners should be systematically incorporated to bring together diverse stakeholders to participate in the decision making activities. On a similar note, political leadership is required to advance the public good.
- A disaster should be ideally seen as a unique opportunity to rectify the problems already existent prior to a disaster in a certain context. To this end, post-disaster recovery and reconstruction strategies strive to incorporate amendments and induce changes that would help overcome the mistakes of the past. A major step on this route is the incorporation of disaster mitigation and disaster resilience measures in post-disaster recovery and reconstruction developments. This is successfully achieved when funds are available and communities and individuals are more informed about the benefits of the risk reduction measures.

The qualitative aspects of temporary houses

Qualitative approaches to the design, construction and provision of temporary houses realize that these houses are more than discrete 'products'. Temporary houses should be optimally considered as cultural artifacts that have particular meaning for the community within which they are located. Even in the most strict top-down approaches, the government should endeavor to lead the way by providing well-researched housing solutions of quality.

In summing up, and as any housing solution must do within the confines of what is affordable, temporary houses should be constructed quickly and easily while encouraging local participation and being able to mitigate damages from future events.

The discussions made in this paper have revealed that the qualitative aspects of temporary houses are multifaceted and thus have to be carefully weighed against one another in order to ensure a successful implementation on the economic, ecologic, socio-cultural and temporal fronts. As an example, the evolvement of temporary houses into permanent residences can have several desirable outcomes related to developing houses of quality and affordability. Nevertheless, in order to ensure the realization of all of these benefits, different considerations should be attentively examined. The paper elaborates on this example in particular as it is governed by certain considerations which aim to decrease the gap between temporary and permanent housing schemes while approximating the qualitative differences. The considerations in question include:

Enforcement of legislations and taxes

The compliance of temporary houses to building legislations and taxes' regulations can contribute significantly to the evolvement of temporary houses into permanent residences. Compliance to building legislations includes building heights, areas and interior plan layouts. Taxes' regulations also ensure an equitable and fair relationship between the house occupants and the government. This can facilitate the evolvement process without placing bureaucratic and official hurdles in the way.

The contextual circumstances and conditions of the temporary housing settlements

A temporary housing settlement is the urban complex resulting from erecting temporary houses along with other services (educational, health, etc.) to serve the disaster affected community. When temporary houses evolve into permanent residence, their

temporary settlements consecutively evolve into permanent developments. Taking into consideration that the practices of living do not only include the aspect of residence, then the contextual circumstances and conditions of the settlements themselves are much in question at this point. Such contextual factors include:

- The physical characteristics of the temporary settlement (surface area, topography, altitude, ambient temperature degree, wind speed, relative humidity, etc.).
- Availability of (or distance to) vital services like education, health and work.
- Availability of infrastructure services.
- Relationship between the temporary settlement and the pre-disaster settlement.
- Vulnerability of the temporary settlement to future disasters.
- Clustering criteria of the housing units within the temporary settlement.
- Ease of accessibility to the temporary houses within the settlement.
- Economic prospect of the temporary settlement.
- Socio-cultural, educational, and financial standards of the temporary settlement occupants.

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