POTENTIALS OF SHIPPING CONTAINER BUILDINGS AND THE IMPLICATION TO NIGERIA HOUSING CHALLENGES

Zaki, Blessed Mazadu (B.sc Arch, M.sc Arch) & Danraka, Musa Mustapha (B.sc Arch)
Department of Architecture, Nuhu Bamalli Polytechnic, Zaria

ABSTRACT
In Nigeria, most people live in poor quality housing and in unsanitary environments. This problem of inadequate housing has been compounded by the rapid rates of urbanization and economic growth. The low and middle income earners are the worst hit as property developers prefer building for the high end markets. Government too is losing appetite to invest in mass housing for the low and middle income earners. Due to this, the percentage of development of slums is at a high. This has led to a point where there is a need to be more creative and innovative in addressing Nigeria’s housing problem by introducing cost effective and environmentally friendly housing solutions. ISO shipping containers are widely available and as various pioneers have shown, can be a low cost building resource. This technology is by no means new in Nigeria. It is used as make-shift shops, emergency shelters, site offices, storage facilities but it’s usage as a major building component is relatively foreign to professionals in the building industry. Therefore, this paper sets out to provide insights on the viability of using ISO shipping containers to provide solutions to housing shortage in Nigeria. A critical review of literatures was carried out and it revealed that the ISO containers have it’s benefits and shortcomings, and conclusions were drawn which indicates that the advantages of utilizing this ISO shipping containers unit outweigh any disadvantages especially with present Nigerian housing scene which we will discovered later in the paper. Recommendations were proffered on how the shipping container building can be projected positively in tackling Nigeria housing needs.

Keywords: Housing; ISO shipping container; Eco-friendly; Low and Middle Income Earners, Nigeria

1.0 INTRODUCTION

Housing (adequate shelter) is recognized world-wide as one of the basic necessities of life and a pre-requisite to survival of man (Agboola, 2005, UN–Habitat, 2006; Anofojie and Adeleye, 2011). Man, wherever he may find himself has always desired a suitable shelter for living, protection, comfort, relaxation and some other uses. Through the ages he has not stopped searching for a befitting accommodation to meet his needs (Madziga, 2012). But the Nigerian housing market currently lacks the capacity to provide a sufficient number of affordable living and working space to meet existing demand. In fact, the housing deficit in Nigeria is estimated at 14 million units and bridging this gap will cost an estimated N49 trillion ($326 billion); this assumes the cost of N3.5 million per unit. (Sun Online news, 2008). With rising cost of building materials, difficult process of accessing land for housing and hardly a structured mortgage sector, achieving sustainable Nigeria housing seems not feasible in the next 20 years. As reported by Agabi, (2014), the low and middle income earners are the worst hit as property developers prefer building for the high end markets. They often site harsh business conditions like huge cost of funds, even at that the credits are short term tenured, expensive land and high cost of construction. Thus to break even and remain in business, the developers say it only makes economic sense to serve those who have capacity to rent, lease or buy the properties and pay immediately. This has become a concern for both the government and many individuals. Appreciating these problems, both the government (Public developers) and these individuals
(Private developers) through their various activities strive to balance the gap in housing supply and demand, but the cost of building materials, stringent loan conditions from mortgage banks, government policies amongst other problems have been affecting housing delivery (Ademiluyi and Raji, 2008 as cited in Oloto and Adebayo, 2012). At the moment, government is losing appetite to invest in mass housing for the low and middle income earners. To demonstrate its waning appetite to invest in housing, government has been wooing the private sector to step up investments in mass housing. Consequently, the government at some point called on the private sector to be more creative and innovative in addressing Nigeria’s housing problem by introducing cost effective and environmentally friendly housing solutions. It is to this effect that the paper through review of literatures gives insights to what the shipping container building entails, to get a sense of the capabilities of shipping containers as housing units and to retrieve ideas pertaining to specific modifications of the containers with the view of ascertaining whether Shipping Container housing is a viable solution to the housing needs of the urban poor in the Nigerian setting.

2.0 NIGERIA HOUSING SCENARIO

The crisis rocking the housing sector of most developing nations especially Nigeria has various dimensions, ranging from absolute housing unit shortages, to the emergence and proliferation of slums/squatter settlements, the rising cost of housing rent and the growing inability of the average citizen to own their own houses or procure decent accommodation of their taste in the housing market (Mudashir and Ahmed, 2010).

According to Adeleye, (2008):
- 2006 estimates Nigerian population at 140million.
- 30%-40% of the total population live in the urban areas, with an average household of 5persons.
- The occupancy ratio of houses in Nigeria is 6 persons per room of 20m2.
- About 60% of Nigerians are without adequate shelter (under-housed and no housing).
- Residential home ownership in Nigeria is less than 25%. Compared with 75% international Benchmark

Adeleye, (2008) went further to give housing Needs and Deficit Estimates which says that;
- Currently, there is an estimated housing deficit of 14—17 million housing units
- The estimated amount required to provide for the deficit is estimated at US$150-200 billion
- There is need for the provision of 500,000 units per annum for the next 40 years
- An average developer cannot deliver more than 2,000 housing units in 12 months
- Housing issues will remain one of the primary social focus in Nigeria for the next 20 years or more.

That the Impediments to Rapid Housing Growth is due to the following:
- The land use act restricts access to land that have no titles on them and limits development of housing units
- High cost of building materials
- Building materials are very expensive and not necessarily of the appropriate type
- High construction costs
- The cost of constructing developments are high and often unaffordable
- Dearth of good quality construction companies
- Poor quality of construction
- High cost of land in urban areas
- Values placed on land especially in the urban areas are high and their owners seek to make high gains on sale
- Lack of Physical infrastructure and social amenities
- Infrastructure and social amenities are not readily in the rural areas and some parts of the urban
- About 40-60% of housing construction cost is related to infrastructure provision

Against this backdrop, government has been wooing the private sector to step up investments in mass housing. Government went further to launch the Nigeria Mortgage Refinance Company (NMRC) Plc, a Public Private Partnership arrangement between the Federal Government of Nigeria and private sector to develop affordable housing for Nigerians. NMRC was incorporated on 24th of June 2013 as Nigeria Mortgage Refinance Company Plc. Among other functions, the NMRC is to encourage financial institutions to increase their mortgage lending by providing them with long term funding; increase the maturity structure of mortgage loans and assist reduce mortgage rates; and increase the efficiency of mortgage lending by taking a lead role in proposing changes to the enabling environment for mortgage lending as well as by standardising mortgage lending practices of financial institutions. But this sort of PPP approach hasn’t firmed up yet, thus the housing crunch bites even harder. Thus the government at some point also called on the private sector to be more creative and innovative in addressing Nigeria’s housing problem by introducing cost effective and environmentally friendly housing solutions. This has led to the call for Container Building as one of the solutions to Nigeria’s housing needs. This solution has been used in several countries including Netherlands, Australia and Haiti (Agabi, 2014).

3.0 THE SHIPPING CONTAINER

A shipping container (also container, freight container, ISO container, Intermodal container, hi-cube container, box, cargo container, corner box and sea can) is a standardized reusable steel box that comes in standard shapes, sizes and construction virtually everywhere in the world and used for the safe, efficient and secure storage and movement of materials and products within a global containerized intermodal freight transport system (Smith, 2005). When an ISO Shipping Container is used solely for building construction or storage it is then called an ISBU module, or Intermodal Steel Building Unit (ISBU) Green Cube. Since 2006 the Shipping Containers have become very popular and trendy for use as home, emergency shelters, storage, office construction prefab, and business construction purposes. Only recently has the world begun to realize their value, their possibilities are virtually endless.

**Intermodal Steel Building Units** or “ISBU’s” are re-used containers converted for building use. Units are commonly 8ft (2.4m) wide and 20 or 40 ft (6.1 or 12.2 m) long. There are also ‘High Cube’ that are 48 to 53 ft (14.8 to 16.3 m) long. These types of modules are used in low-rise construction, and modified to suit normal room sizes by joining units together, with partial removal of side panels. Unit arrangements are sometimes combined with other structures such as open-plan steel frames.
3.1 Shipping Container Industry

The shipping containers industry produces a lot of these containers each and every year. They are used to transport goods all over the world. It's estimated that 90 percent of the world's trade today moves in containers. One hundred million container loads crisscross the world's oceans each year in over 5,000 container ships (Madziga, 2012). There is a very big chance that a lot of the stuff you own or buy came to you in a shipping container.

In Nigeria the major port terminals are located in Lagos, Port harcourt, and Calabar—namely: Tin Can, Apapa, Lily pond and Kiri-kiri, Roro, Fed. Lighter terminals. Nigeria being a consumer country engages in importation of goods using these freight containers. As such there is a vast number of containers lying fallow after the goods have been cleared and most users do not have any further use for the containers. However major construction companies like Julius Berger, setraco, SCC, saline, Dantata & Sawoe have an abundant supply of these containers which they use to transport their equipment to site, and also for use as temporary make shift shelters.

3.2 Properties of Shipping Container

A typical ISO shipping container is made from ‘corrugated weathering steel’ as specified within BS EN 10025-5:2004 this is also known as 'Cor-ten’ steel. Cor-ten steel is corrosion resistant steel that is used within many industries where exposed steel sections are necessary E.g. Building panels, facades and sculptures.
Table 1: ISO shipping container dimensions

<table>
<thead>
<tr>
<th>Freight container designation</th>
<th>Minimum height (mm)</th>
<th>Minimum width (mm)</th>
<th>Minimum length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>2890</td>
<td>12192</td>
<td>40'</td>
</tr>
<tr>
<td>AA</td>
<td>2591</td>
<td>9125</td>
<td>29' 11 1/4''</td>
</tr>
<tr>
<td>A</td>
<td>2438</td>
<td>6058</td>
<td>19' 10 1/2''</td>
</tr>
<tr>
<td>AX</td>
<td>2438</td>
<td>2991</td>
<td>9' 93/4''</td>
</tr>
<tr>
<td>BBB</td>
<td>2890</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BB</td>
<td>2591</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX</td>
<td>2438</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC</td>
<td>2438</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CX</td>
<td>2438</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>2438</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DX</td>
<td>2438</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**External Dimensions**

**Internal Dimensions**

**source** smith, 2005

Figure 1: Test force per container at all four corners simultaneously **source** smith, 2005
4.0 SHIPPING CONTAINERS AS BUILDINGS

While it is uncertain where the concept of Container Housing originated or who first thought of recycling shipping containers that have outlived their purpose in the shipping industry into structural shells of livable units, the fact remains that at present it is a concept that has been widely canvassed worldwide. The idea of using shipping containers as a building component is by no means new, as Sawyers (2005) identifies. Most shipping container conversions have however
been for temporary accommodation needs, for example. Storage, emergency shelters and site offices. In North America Sawyers describes “farmers and rural folks” as the pioneers using shipping container as permanent, low-cost structures and states that “Intermodal units have become so prevalent in recent years, they are beginning to turn up in Wyoming, Indiana mid other places nowhere near either coast”. Advocates of utilizing this particular material as a building block for construction have enumerated its positive qualities. Among others, the most common factors that have been noted are:

_ By recycling shipping containers that are no longer usable for shipping purposes, thereby considered as ‘junk’, one may do his part in reducing the sources of pollution / eyesore that abound in local ports

_ While these containers are no longer considered seaworthy, particularly in terms of transporting food, it is still structurally sound especially when provided with a good foundation

_ In the light of lowering the construction cost and increasing the speed of construction, a shipping container has the advantage because basically, it already is a shell (i.e. it already has walls, floor, and ceiling)

_ Since the material is actually considered as ‘junk’, one may purchase it at a relatively low price, thereby possibly lowering the total construction cost.

**4.1 Barriers To Shipping Container Buildings**

It is important to note that shipping containers, as a livable space, is not a perfect material, as it has it’s downsides. They include issues like:

_-Severity of heat gains as steel conducts heat very well and containers used for human occupancy in an environment with extreme temperature variations will normally have to be better insulated than most brick, block or wood structures.

_-Inadequate technical know-how as the welding and cutting of steel is considered to be specialized labour and can increase construction Costs.

_-The use of steel for construction, while prevalent in industrial construction, is not widely used for residential structures. Obtaining building permits may be troublesome in some regions due to municipalities not having seen this application before.

_-The size and weight of the containers will, in most cases, require them to be placed by a crane or forklift.

Perhaps the biggest barrier to its usage as homes is the issue of stigmatization which are usually applied to it because they are considered ugly metal boxes left abandoned in urban shipping yards. Transformative thinking and a willingness to move outside of the box can bring this technology to the forefront of urban planning agendas everywhere.

**4.2 Shipping Container Buildings And It’s Implication To The Nigerian Housing Needs**

Nigeria is a country dearth of quantitative and qualitative housing and the resources to tackle these problems are relatively scarce. Housing affordability is extremely limited given the level of unemployment in the country and the low incomes earned. The government’s own capacity to finance housing to meet the backlog is also limited. There is a need for urgent intervention in housing provision just like it has been done in South Africa and China if we want to avoid our cities from being turned into slums. Therefore, it is inherent that we seek for strategies for delivering affordable and eco-friendly housing to the 70% of Nigerians who live below the poverty line ($1per day) (Alagbe, 2013). Also, noting that building materials are believed to constitute about 55% to 65% of total cost of construction input (Mudashir and Ahmed, 2010). According to Agabi, (2014) in the property section of the Dailytrust newspaper, he said the ISO shipping container houses are affordable as it is 30-40 percent cheaper than concrete build and three times faster. These containers are re-usable and if the need for imports exceeds exports as Nigeria finds itself now, there will continue to be a surplus of containers gathering in cities and ports occupying space (Madziga, 2012). The standard dimension of a shipping container means
that they are an excellent modular unit and with inherent strength. Weather-proof nature and availability makes them an ideal modular structural component or as a whole standard accommodation unit. Shipping containers can offer a wide range of building types and configurations, and can be limited only by the technical ability and imagination of the designer. Aside the aforementioned, Pagnotta, (2011) posited that “Reusing containers seems to be a low energy alternative, however, few people factor in the amount of energy required to make the box habitable. The entire structure needs to be sandblasted bare, floors need to be replaced, and openings need to be cut with a torch or fireman’s saw. The average container eventually produces nearly a thousand pounds of hazardous waste before it can be used as a structure”. He went further to say that to make an adequate sized space, multiple boxes need to be combined, which again, requires energy. This he says is because dimensionally, an individual container creates awkward living/working spaces. Taking into account added insulation, you have a long narrow box with less than eight foot ceiling. Pagnotta (2011), finally concludes that it is typically not the best method of design and construction, but it is however a design method that should not be ignored and if employed where desperately needed like in a developing country. It could bring comfort to countless lives. Shipping container homes makes sense where resources are scarce, containers are in abundance, and where people are in need of immediate shelter such as, developing nations and disaster relief. From Pagnotta’s statement, Nigeria falls in that situation and therefore, the ISO shipping container building presents an eco-friendly and economical choice towards addressing housing deficit issues in Nigeria.

5.0 Conclusions And Recommendations

Conclusively, after an overview of ISO shipping container buildings, it reveals that it has its merits and demerits and in relation to the dearth of houses in Nigeria, it presents a sustainable and economical choice towards tackling housing shortage as the advantages outweigh the disadvantages at this juncture. It is recommended that the realignment of the building industry professionals towards adopting sustainable approaches in their designs is necessary and their adequate technical ability towards the conversion of this material into habitable living spaces is required. Furthermore, the enlightenment of the public on the positives of this material will help change the general notion of it been just a “steel box”.

REFERENCES


