

Housing Design for Elderly People in Tanzania; Significance of Adaptable Housing

Huba Mary Nguluma¹, Emmanuel Fares Kemwita²

¹Institute of Human settlements Studies, Ardhi University, Dar es Salaam, Tanzania

²School of Spatial Planning and Social Sciences, Ardhi University, Dar es Salaam, Tanzania

Abstract—Access to adaptable housing for elderly people has been one of the greatest challenges in Tanzania. The current trend of designing houses which do not accommodate key needs of elderly people and non involvement of professionals, contribute to this major setback. This paper therefore addresses importance of adaptable house design for elderly people in Tanzania. A case study research strategy was used where Mlalakuwa informal settlement in the city of Dar es Salaam was selected as case study area. Interviews, sketching, measuring and observations were used as data collection tools. Empirical results have shown that elderly people are facing a lot of problems in the use of spaces in their houses consequent upon failure by designers to consider special requirements of this special category of Tanzania population. Most of the houses studied have steep steps which make it difficult to be used by elderly people. Other shortcomings noted are slippery floors, squatting toilets, bathrooms lacking hand rails, user unfriendly kitchens. All these items make it difficult for the elderly to use space. Non involvement of professionals' in house design to realize adaptable housing design is also a major issue in the country. This paper provides undocumented insights about the importance of adaptable housing for elderly people hence the essence for considering special requirements of old people at the onset of house design. Professionals, particularly architects ought to be involved in design solutions to accommodate use of outdoor and indoor spaces at plot and house level for the benefit of elderly people hitherto neglected.

Keywords— Adaptable housing, Elderly people, House Design, Professionals.

I. INTRODUCTION

One of the major challenges in the first half of the 21st century is the increase of old people and people with disability who live in private houses. According to Herd, *et al.* (2003) housing design will need some inexpensive but important changes to cope with this demographic change. The life style and culture of building homes for elders is not practiced in developing countries particularly in Tanzania. Most old people live at their homes with relatives. However, old people require special care in housing design to accommodate their requirements and special needs.

The house, built with a young family in mind, is not capable of easily accommodating concerns that go along with growing old (Vinnitskaya, 2013). It is further contended that, there is lack of diversity often found in an auto-dependent environment which lacks nearby amenities that poses a significant problem for aging population. In that case, planners

and architects must consider what a private single-family house should look like when the demographic of the people living in it change. A need arise to promote the role of the stakeholders and actors to incorporate adaptive design features in housing designs that will be user friendly to all ages including elderly group.

Adaptable housing design was conceived in 1980s by Architect Ron Mace (1941-1998) as a way to ensure that the concept of inclusion is informed into conventional design process. Adaptability concept was developed to secure injured people, elders, and people with disability to get access to difficult parts of the building (both inside and outside), particularly the areas where the aspect of disabilities have not been taken into consideration. Joines (2009) states that, the difficult parts of the buildings faced by old people and people with mobility limitations include; landscape designs with steps, stairs inside the building, steep slopes, steps inside the building and others.

Joines (2009) further argues that; access is not enough in housing design. The housing design should be “adaptable”. It should take into consideration the concept of designing products and the built environment that serves the needs of people regardless of their age, ability, or status in life. The house designs seek to encourage attractive, marketable products that are more usable by everyone.

1.1. The Meaning of Adaptable Housing Design

Adaptability is defined as a means of thinking ahead during the construction of a house. This saves time, money and hassle later on by avoiding the need for costly renovations. It is the capacity of buildings to accommodate substantial changes. For example, providing an unfinished space in a new home that can be converted later (CMHC, 2010).

CMHC, (2010) further indicates that, aging in place is viewed as that ability to remain in one's home safely, independently and comfortably, regardless of age, income or ability level throughout one's changing life time. Furthermore, British Columbia Building and Safety Branch, (2007) argues that, an adaptable housing is an approach to residential design and construction in which homes can be modified at minimum cost to meet the occupants' changing needs overtime. By incorporating flexibility into home design from the start, adaptable housing helps people to stay in their homes through illness, injury, and aging, it provides more accessibility for the people with disabilities and reduces the cost and time for future renovations.

An adaptable housing can also be referred to as housing that incorporates provision for inexpensive modifications to houses that can be adapted to meet particular needs of a resident (ibid). However, an adaptable housing design includes basic accessibility features, such as corridors, doorways, bathrooms, toilets and kitchens that facilitate easy and comfortable access to people with mobility limitations and the old people.

Adaptable housing does not only benefit the old people, but also making homes more accessible by visitors who have mobility limitations. It is the most cost effective approach to facilitate an independent living. The added initial construction costs of an adaptable housing are minimum compared to the costs of adding accessibility features after construction (British Columbia Building and Safety Branch, 2007). Hartije (2004) states that, housing has a great impact in people's daily lives. Aging in place becomes possible only if accessible or easy adaptive features are incorporated into the design. As an elder's needs change through the aging process, an adaptable housing is ready to suit those changes.

Vinnitskaya, (2013) argues that, without adaptability concept, how can it be improved to be a space that accommodates different aspects of aging? How does it address accessibility or upkeep? Can it be converted into multiple dwelling units or rentable spaces when children grow up and "leave the nest"? These are realities that change what it means to design for the future, especially in cases where many elderly citizens prefer to continue living in their homes.

1.2. Adaptable Housing Design for Elderly at Global Level

Globally, particularly in Europe and America, the elderly age is considered to be over 65 years of age. However, the household structure shows that, within the European countries, majority of those aged 65 years old live alone (31.1%) or as a couple (48.3%). In 2009, approximately nine of ten persons aged 65 and above in Germany, France, Finland and the United Kingdom do live independently in their own home. In the Netherlands, the percentage stands at 95 percent (Stula, 2012).

Regarding adaptable housing design in developed countries, Stula (2012), states that development of age-appropriate forms of housing for instance in 13 European countries from 2007 reached the average of only one percent of all those residing in Europe with barrier-free design or have been adapted to the needs of elderly people. These exist within the housing stock of ten countries. In particular, Belgium, Germany, Finland, France, Great Britain, Italy, the Netherlands, Austria, Poland and Sweden.

Stula (2012) reveals that; in developed countries like Europe the life style and demographic structure of having a large number of old people make it necessary for designing adaptable houses to cater for that group. Stula (2012) further shows that the number of old age is increasing unlike the previous times. This indicates that, knowledge of incorporating adaptable housing design to include the old people and people with mobility limitations is becoming of paramount importance.

Estimates show that, there were 600 people aged 60 and over in year 2000 compared to 1.2 billion in year 2025 and 2 billion by 2050 (WHO, 2005). However, according to U.S Censure Bureau (2000) there were 34.9 million elders aged 65 and over in the year 2000, and it was again estimated that in the year 2040, the elderly aged 65 and over will increase to 71.4 million, doubling the number in the year 2000 estimates. This gives a clear indication on the need for adaptable housing.

Adaptable housing design for elderly has been widely practiced in many developed countries such as Germany, Canada, France, Finland and the United Kingdom where mostly elders live independently in their own home. Literature shows that in the Netherlands, the percentage goes to about 95 percent. In these countries, elderly people more often live in common households together with their children. Across Europe, this only applies to 4.6 percent of all of elderly citizens (Eurostat 2011, in Stula, 2012). The need to consider adaptable housing for future during the design in order to include the elderly age is, therefore, considered important.

1.3. Adaptable Housing Design for Elderly in Tanzania

In Tanzania the elderly age is counted at 60 years old and above, which is the retirement age for the government workers (Mboghoina, & Osberg, 2010). Furthermore, observation shows that, when people are 55 years old or whereabouts they start changing their housing to better meet their finances, lifestyle or present and future needs. This leads to housing modifications done by people themselves looking for adaptive features in both indoor and outdoor areas to meet their needs such as rental housing for gaining income, modernization and others (Nguluma, 2003). According to El-Hussain, (2018), there is an attitude of owners to change their houses to cope with socioeconomic needs of residents.

The Building Regulations Act of 2008, Tanzania housing Policy Draft of 2009 and regulations as used by the Local Government Authorities like Kinondoni, Ilala and Temeke Municipalities, have shown little concern on adaptable housing design for elderly. For example, the location of building elements like staircase for exit in case of fire, the appropriate building materials that conform to the health of human being, considerations of the room sizes which have to conform to human scale (ergonomics) have expressively been recognized and included as an important reference during housing design. Despite the provision of these building elements in the legislations as mentioned above, little is known on adaptable housing design for the elderly in Tanzania.

In Sub-Saharan countries, Tanzania inclusive, adaptable housing design for old people has not been taken into considerations. Literature on these countries (Sub-Saharan countries) regarding elderly housing design does not give a substantive example for the same. Similarly, government authorities also have not put emphasis on compliance with guidelines, principles and policies.

II. METHODOLOGY

Empirical evidence for this paper comes from field studies conducted from Mlalakuwa Informal settlement in Dar es Salaam city. The City was considered an appropriate area for the study because it is the most rapidly urbanizing centers in the country as well as in the sub-Saharan region. Given its geographical location, its economic and political stature, more people are attracted to reside in the city. The population is growing rapidly indicating that more and more people will be residing in the city as compared to any other urban centres in the country and, therefore, a large number of elderly people. Dar es Salaam is also witnessing a large number of people living in informal settlement. The city therefore represents an interesting case with challenging exposition of the study phenomenon.

Mlalakuwa is an informal settlement rich in information concerning informal development in relation to realization of adaptable housing design. Also being an informal settlement, it consists of housing designs which have been formally designed by professionals like architects and those built without involvement of professionals. Therefore, both houses formally designed by professionals and those which were not professionally designed, assisted in the collection of useful information on the state of adaptability of existing houses. Mlalakuwa, therefore, qualified to be a case to study for adaptable housing design for the old people in Tanzania. Data collection methods employed included literature review, interviews, where a total of 60 elderly people were interviewed and more than 40 houses were studied. Field observations, sketching and photographic registration were also used as data collection tools.

III. FINDINGS AND DISCUSSIONS

3.1. Use of Space by Elders at Plot Level

The study reveals that, plot size may inhibit adaptive outdoor design, limit the setbacks in each side of the building and hinder movement around the house. Field results shows that; out of 60 elders interviewed, 75% (45 respondents) had size of the plot less than 600 square meters due to tight land parcelling and informal housing development. Within those small plots more than one house was developed. Similar findings were noted by (Mohammed & Suleiman, 2006) who reported that residents tend to build almost 100% of plot size. This type of development reduces the size of the plot, which denies building setbacks. This results into narrow roads which renders access for Municipal services such as fire fighting and sewerage disposals quite cumbersome. The rest 25% (15 respondents) had size of the plot adequate to accommodate spatial functions with proper setbacks to allow easier access from Municipal services and movement around the houses.

Building regulations from the Local Government Authority in Tanzania recommends a minimum plot size of 20m x 30m which is a 600 square meters. This is regarded as a high density plot. Nevertheless this size is enough to accommodate indoor and outdoor spatial functions in all house types occupied by elders in settlements. The minimum size of the plot also allows for a minimum setback of 1.5m on the left

and right sides of the house, 3m and 5m for rear and front sides of the house, respectively. In Mlalakuwa settlements most of the plots surveyed are less than 600 square meters (Figure 1).

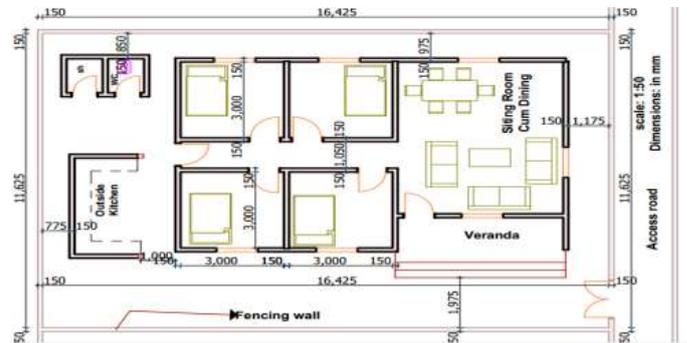


Fig. 1. Size of the plot and building setbacks.

3.2. Landscape Design

Research findings reveal that 86% (52 respondents) had their outdoor spaces poorly designed. The poor landscape design results from insufficient land which is enough to accommodate landscape elements during the design stage. Similar findings were reported by Mohammed & Sulaiman (2006) who reveals that residents tend to build almost 100% of their plots for housing. The rest, 14% (8 respondents) had their outdoor spatial functions designed adaptively to consider aging factor. According to CMHC (2013), landscape creates social interaction and quality outdoor living.

The study shows that, important elements which are necessary in the design of a landscape taking into account old age are: parking lots, outdoor shade for resting and the garden space in terms of hard and soft landscapes. Similar findings were reported by Bateman et al. (2013) who observe that design of a landscape requires: legibility and way finding; territoriality and access for non-residents; pedestrian access and safety, vehicular access and traffic management. Parking lots are important for visitors whereas soft and hard landscape takes care of movement of the cars and pedestrians at house and plot level.



Fig. 2. Outdoor garden space with enough size of the plot for setbacks, soft and hard landscape.

Outdoor shade provides pleasant environment and offers maximum relaxation for elders who spend more time at home. Other results show that, elderly studied houses had no clear and defined paved surfaces, parking lots and proper treatment of the sloping terrain at the site due to informal housing

development at the settlement and little knowledge on landscape design.

Less involvement of professionals, limited space for housing, lack of knowledge and poor financial capability, are problems in realizing adaptable landscape design that consider old age. Additionally Gloria et al. (2006) states that neatness and naturalness are among the important requirements for an attractive landscape designs. Out of 60 elders interviewed only 8% (5 respondents) were documented for having outdoor spaces designed to consider aging. These included enough spaces for parking, outdoor shade, clearly defined soft and hard landscape (Figure 3). The rest, 92% (55 respondents), had their landscape poorly designed.



Fig. 3. Outdoor space; with a shade for outdoor resting during the day.

In an interview with a male elder aged 71 years regarding outdoor spaces the following was observed; “Before I retired, this space was not as important as it is now, because I rarely had to stay here due to busy work schedules. Since I retired this has been my favourite space to relax particularly during the day”

3.3. House Entrance

The study results reveal that, 66% (40 houses) of the houses studied have main entrances built with steep steps in which risers had dimensions of 150mm to 200mm. This inhibits comfort use particularly in old age and in case of mobility limitations. The rest, 24% (20 houses) have main entrances with minimum steps and shorter risers of less than 150mm high. These have desirable risers for elderly persons; however, they still impose challenges in case of mobility limitation due to absence of ramps or zero risers

The study further indicates that steps were introduced in the houses due to differences in levels of landscape terrain. In such situations the high level of the plinth with steep risers may be undesirable and difficult in accessing both indoor and outdoor parts of the house. Similar impacts are reported by Sloane et al (2001) who contends that poor conditions of stair surfaces; objects on stairs, too high risers, if poorly designed are dangerous in old age and may lead to frequent fall. Evidently high riser on steps may lead to accidents or injuries unless precautions are taken during design stage. Introducing elements like ramps at the main entrance in housing design is favourable for use by all age groups regardless of any future physical changes where people grow old. Out of 60 elders interviewed 93% (56 respondents) expressed that steep steps may be undesirable to elders and 7% (4 respondents)

expressed no position as their houses were built on a flat surface where no raised steps were incorporated.

The studied houses have no ramps at the front entrance to facilitate movement for elderly persons. None of the houses owners considered use of ramps at the entrance at the design or construction stages. The type of steps which were provided during the design stage are straight run or stairs (six to eight steps) which stretch from lower to upper level in one straight run and some lacking landing (Figure 4).



Fig. 4. Steep steps on the entry way inhibiting free passage at house level.

3.4. Indoor Use of Space by Elders

The indoor spaces studied were: Room sizes, Size of the house, Lobby, corridors and balconies. Others were Staircases for vertical movements, steps on entrances and interior provision such as inside the houses, bathrooms, toilets, kitchen, fittings and fixtures.

3.4.1 Rooms sizes

Particularly those used for sleeping were designed by taking into account number of people expected to use them. Out of 60 elders interviewed, 46% (28 respondents) informed the researcher that most of the room sizes in their houses had dimensions between 3meters x 3meters or ranging from 3.2 meters to 3.5 meters. The decision on what the room size should be was given by house owners in collaboration with Artisans (*Fundi*) and not professionals like Architects, engineers and planners. Similar findings were reported by Nguluma (2013) who states that *Fundi* is a self-educated “Architect” and he/she performs housing design works in collaboration with house owners. The sizes of the rooms in the studied area are sometimes not adequate to meet the number of extended family and the immediate family. Sometimes house owners’ live with or without relatives or own family; whereas sleeping room may occupy more than one bed at a time in order to accommodate the entire family. This calls for housing extensions by adding more rooms designed and carried out by artisan.

3.4.2 Lobby, corridors and balconies

Lobbies and corridors are important in providing flexible movement inside the house. According to CMHC (2013), the lobby and corridors especially in a multi-unit development can be a community space or an area where residents can meet each other. Corridors can have much more functions than simply areas of access and circulation. In residential houses corridors are important spaces for circulation and passing

furniture (*ibid*). Out of the 60 houses studied, 65% had narrow corridors and lobbies with dimensions between 900 mm to 1000 mm wide. Usually, wide corridors and lobbies in residential houses at least 1.2 meters to 1.5 meters for elders are desirable. They ensure maximum movement within the house and allow passage of furniture and use of wheel chair without undesirable constraints. This problem can be solved by involving professionals during the design stage to consider space use and required standards for old people. Results of this study shows that houses whose house owners and tenants live together experience problem of mobility due to multi use of indoor spaces including cooking and storing of utensils. Similar findings are reported in Buguruni Malapa and Ilala Wards in Dar es Salaam (Magina, 2011). The rest of the houses studied (35%) have corridors and lobbies designed with dimensions between 1.2 meters and 1.5 meters which provides maximum circulation inside the house. Multistorey residential houses (Maissonattes) were designed with provision of balconies for accessing outdoor environment for view and resting. Out of 60 house owners interviewed, 25% (15) had multistorey building and are of the view that balconies are important for viewing outdoor environment, and provides resting and relaxation atmosphere for elders, particularly when temperatures are high in and outside of the house. Similar findings are reported by Gardner (2011) who testifies that balconies serve as spaces of thresholds and transitory zones in a house. The rest, 45 (75%) house owners interviewed have single storey houses such as detached and Swahili house types. Most of the single storey house occupiers who responded to our interviews, observed that, balconies are important spaces in a house for outdoor living, particularly for the old who spend most of their time indoors.

3.4.3 Steps and ramps inside the house

Ramps provide smooth, movements especially for elderly people and those using wheel chair. They are very effective in exhibiting spaces if designed with less pitch and slope. This study reveals similar findings as noted by Olof et al (2009) that, steps created inside the house were undesirable and dangerous to house users, particularly in old age and for disabled people. It was also noted that steps inside the house were designed to distinguish between different levels, for instance, sitting room being sunk for two or more steps or dining room raised up two or more steps. Out of 60 studied houses, 55% (33 houses) have steps inside the house created due to different reasons like the terrain of the plot, distinguishing levels of different spaces and aesthetics. The rest of the studied houses, 45% (27 houses) had no steps created inside the house. However, the findings show that if steps created indoors are designed properly the house may provide pleasant ambiance for the interior part of the house. In essence, however a careful design consideration, including the provision of ramps, should take into account old age and mobility limitation; otherwise steps inside the house when designed without precaution can lead to injuries, and increase frequency of falling down especially for elders. 75% (45 respondents) of 60 house owners interviewed responded that

steps inside the house and at the main entrance are undesirable at an old age while the rest, 25% (15 respondents) observed that steps provide pleasant look, therefore requiring, a careful design to take into consideration aging (Figure 5).

It was revealed that with old age or disability such as poor vision or any physical impairment, walking over a raised space such as steep risers becomes very difficult. Similar findings were reported by Magina (2011) who observes that everyone is thought to be disabled in different phases of life. Thus, designing houses without taking into account old age or any other physical unforeseen disabilities may create unnecessary expenses or injuries which could have been avoided during the design stage.



Fig. 5. Steps inside the house undesirable in old age and in case of mobility limitation.

3.4.4 Staircases in multi-storey houses

The study reveals that elements like staircases designed in multi-storey houses are undesirable to elders as they grow old. Despite the function of the staircases in accessing upper floors it becomes difficult for old people to use them (Figure 6).



Fig. 6. Steps inside the house undesirable in old age and in case of mobility limitation.

Steepness of staircases render elders become tired due to the difficulty associated with climbing stairs. Similar findings are reported by (CMHC, 2013) who contends that stairs can be potential hazard areas for the visually impaired and those with difficulty in walking or people in old age. Making flights of stairs short and as straight as possible help to lessen the stated hazards. Handrails should be provided on both sides of staircase and should be easy to grip (*ibid*). Results of this study

have shown that, elders decide to shift from the upper floor to ground floor to avoid frequency of using staircases.

Out of 60 elders interviewed, 25% (15 respondents) who own multi-storey building expressed that using staircases to access upper floors in old age is undesirable. Similar findings are reported by Di Pilla (2004) who identifies steps/stairs and floors as number one and two in the fall of old people. The rest, 75% (45 respondents) had single storey houses where vertical movement is not involved. We reiterate our findings that, designing a multi-story building require involvement of professionals during the design stage to ensure a house would have future inclusion to offer alternative ways and which takes into account user's age.

3.4.5. Toilets and bathrooms

Bathrooms and toilets are among the indoor spaces studied as challenges relating to old age. According to CMHC (2013) on universal design principles, multi-unit housing developments showed that, it is a good idea to plan a large bathroom at the outset. If possible, to include a space such as a closet next to the bathroom or install removable cabinets that would allow for a later expansion. Additionally, CMHC (2013) argues that a house of two or more storey, should allow for an option to create a full bathroom on the ground floor to help in facilitating aging in place. Bathtubs facilities are more likely to cause accidents than showers. Therefore seats, steps and special tubs that facilitate stepping in and out can be helpful (*ibid*).

Results of this study shows that, 60% of the houses studied have toilets and bathrooms facilities located outside (outdoor) the house while the rest, 40% are located inside the house (indoor). The study also reveals that lack of infrastructure such as inadequate water supply in the settlement led to decision by households in the settlement to provide toilets, bathrooms and kitchen spaces outside the house for ease cleanliness. Similar findings are reported by (Kyessi, 2002) who reveals that more than 70% of housing developments in informal settlements are beset with poor provision of infrastructure services, for instance. Clean and safe water supply, road access, electricity and drainage systems.

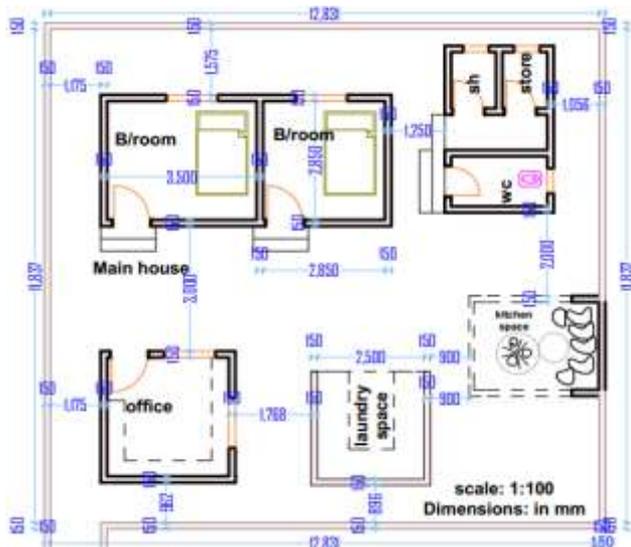


Fig. 7. Toilet facility accessed from outside.

Toilets and bathrooms designed inside the house (indoor toilets and bathrooms) are much more convenient for elders to access, especially during the night. Conversely, toilets and bathrooms located outside the house are cumbersome to elders, especially during the night due to security reasons and sometimes land terrain. (Figure 7). A major problem identified in the use of toilet facility regardless of its position is the use of Asian type toilets. In old age, Asian type requires a person to squat as compared using the facility contrary to western type which allows sitting thus comfortable.

86% (52 respondents) of 60 households interviewed are using Asian type toilet facility. The rest, 14% (8 respondents) have Western type toilet facilities which as already observed are desirable in old age. The study has further established that people install Asian toilet facility in their houses because of lower cost of this type of facility in comparison with the Western type facility and poor forward looking planning to accommodate changes in age.



Fig. 8. Asian toilet; a critical problem in old age due to squatting.

There is also a health related reason for preference to Indian type toilet facility. In the course of the study some interviewees observed that Western type facility is susceptible to contamination, especially when used by the public as compared to the Asian type. Our study on the bathrooms facilities reveals that, bathrooms without fittings, such as shower trays, shower tapes and grab bars are undesirable for elders. Similar findings were reported by Kose (1997) who identified grab-bars at the toilet and bathrooms, lowered bathtub facility in the washroom and raised toilet seats as necessary design requirements in old people. The absence of these facilities is forcing elders to use buckets for bath taking. This results in back pains due to continued bending. Finishing materials such as floor and wall tiles in bathrooms may also be dangerous to elders if proper and careful selection is not considered during the design stage. For example, in case the toilet facility does not have grab bars for support yet slippery floor tiles have been used in the bathrooms, incidences of injury due to accidental slipping and fall are inevitable. Similar findings are reported in Sweden, Canada, United States and Japan by Sadigh et al. (2004) who stated that injuries are facing old people due to frequent fall in bathrooms and toilets.

Explanations from the respondents of our study, shows that, despite having a toilet built inside the house, absence of grab bars (fittings on the walls) and shower tapes in bathroom facilities is a serious problem. Having slippery floor tiles fixed without professional advice may lead to sudden fall in toilets or bathrooms. Apparently the major reason for using floor tiles which happen to be slippery is associated with two factors; one being affordability in terms of pricing of tiles as cheaper tiles are relatively low priced due to poor quality and secondly absence of professional advice 85% (51 respondents) out of 60 households interviewed had bathrooms built without facilities such as grab bars for support and shower tapes (Figure 9).



Fig. 9. Combined bathroom and toilet without hand support fittings.

3.4.6. Kitchen

According to CMHC (2013), the kitchen is a critical and important space in residential houses. In our view kitchen area should include adequate space for wheelchair movement, removable lower counters, and adjustable-height counters and should be able to provide for easy workability by everyone. Out of 60 households interviewed, 55% (33 respondents) were using the outdoor space only for cooking activities and their houses were not designed with a kitchen space inside the house. The rest, 45% (27 respondents) had both indoor and outdoor kitchen spaces. Houses which had kitchen spaces inside the house were using electric cookers or gas cookers. Notwithstanding the designed indoor kitchen, the option of having outdoor kitchen was considered very important.



Fig. 10. Cooking space which lacks adaptive facilities to assist in old age.

The use of charcoal stove for cooking activity involves the user tending to bend down frequently in order to accomplish the exercise of cooking or else seating on a lower seat; a

situation which leads to back pain problem for elderly persons. The provision of worktops or raised charcoal stoves would facilitate in cooking comfortably (Figure 10).

Furthermore, the study reveals that low income and absence of professional inputs are ranks among the major reasons contributing to lack of standard kitchen that takes into account aging factor. Similar findings were reported by Sakloglou, & Panopoulou (1998) who said that poverty, particularly absolute poverty, is closely associated with old age and poor housing design

3.4.7. Fittings and fixtures

It is a finding of this study that people build houses without the provision for age change in the course of using the house over years. People worry most about construction cost. The dominance of the cost consciousness leads to poor application of building material as a result of which important fittings or fixtures which would become essential in advanced age, are ignored or not taken into consideration. Fittings and fixtures are to be incorporated carefully and at an earlier stage taking into account future changes as people grow old. They are normally fixed inside the wall before doing finishing of the house such as plastering, colours and tiles in order to avoid repetition of the work and poor workmanship. It is important therefore to consider these key devices and incorporate them during housing designs in order to avoid injury and unforeseen expenses in the future. Out of 60 households interviewed, 75% (45 respondents) showed non-provision of fittings installation such as grab bars in their houses, the reason being the cost of the materials and lack of professional input like technical advice at the design stage. The rest, 25% (15 respondents), used professional advice during the design stage and thus considered fittings and fixtures at the design and prior construction stages.

IV. CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions

Adaptable housing for elderly is considered important. In developing countries like Tanzania, there is inadequate implementation on provision of adaptable housing. There is also lack of awareness on adaptable housing; Out of the houses studied only few showed elements of adaptability in the residential housing design. It is also clear that professionals like Architects understand clearly what it means by adaptable housing but they seem to be rarely involved or available to provide advice to the needy on the importance of adaptable housing. Even regulations for building consents and permission do not bind them to do so. Similarly there are no regulations to govern development of adaptable housing. It is, therefore, high time the enacted regulations, guidelines and policies to implement housing for elders. When a house is designed with an idea of adaptability, it helps to accommodate the needs of an aging population as it does not require modifications such as widening spaces like corridors, lobby, doorways, steps, staircase, increasing height of the house, reducing number of rooms as children leave home and the use of floor finish which is slippery and the challenges of squatting toilets. Having an adaptable housing reduces the construction cost into the future because such houses would

not need modifications, alterations and or extensions such as introducing ramps, breaking down steps on entryways and elevating toilet seats.

4.2. Recommendations

In order to impart knowledge on adaptable housing design for elders the following recommendations are regarded important;

- The entrances should be well designed, considering minimum steps with not more than 150 mm riser. The going can be maintained at 300 mm or introducing ramps with about 3 degrees slope as the option to use in case of physically impaired illness or immobility condition when a person grows old.
- The living areas should be designed or built with large windows for light and ventilation depending on the dominant climate space should be big enough to allow easy movement even for those using wheel chair.
- Toilet facilities need be designed to accommodate future use. Provision of enough space in the toilet to accommodate facilities like Western WCs so as to solve the problem of squatting
- Bathroom facilities should include grabbing bars and adjustable over head showers to provide comfortable environment during old age
- As for residential houses which are double storey, should be designed with a comfortable bedroom at the ground floor to serve for the future when a member of family grows old. Also for those who are economically able, a space for an elevator should be left to serve the purpose at a future time should the need arise.
- The kitchen space especially for the low income people, who cannot afford modern fittings, should be provided with alternative raised work tops to assist elders from bending during cooking.
- When designing walkways, it is important to consider non-slippery surfaces, and good lighting. The design should also take in to consideration micro-climate issues such as wind, sun and shade.
- Steps should be designed with extra care like providing ramps about 3 degrees inclination to assist easy and comfortable use for the elderly.
- Professionals should specify and advertise the use of prefabricated building materials such as precast panels which can easily be assembled and or dismantled without much alteration as compared to reinforced concrete blocks. In the event of the need to make internal alterations or modifications, these materials are considered light compared to reinforced concrete; thus requiring limited vertical support unlike concrete which needs much vertical support and time consuming curing periods.

REFERENCES

- [1] Canada Mortgage and Housing Corporation (CMHC), (1996). Applying Universal Design Principles to a Housing Unit. Ottawa, Canada
- [2] Canada Mortgage and Housing Corporation (CMHC) (2008). Research Highlight Socio-Economic series 08-014): Community Indicators for an Aging Population, Ottawa, Canada
- [3] Canada Mortgage and Housing Corporation (CMHC), (2010). Accessible Housing by Design: House Designs and Floor Plans, Ottawa, Canada
- [4] Canada Mortgage and Housing Corporation (CMHC), (2013). Creating Housing and Communities for all Ages: the Principles of Universal Design. Designing the Project, Volume 4. Ottawa, Canada
- [5] Canada Mortgage and Housing Corporation (CMHC) (2016), Accessible House by Design, Canada
- [6] Di Pilla, S. (2004). Slip and fall prevention: A practical handbook. Second Edition, CRC Press
- [7] El-Hussain, M.A. (2018). "Factors of Spontaneous Physical Housing changes in Urban Centres of South West Nigeria". *Architecture Research Journal*, Vol 8(2), pp.74-85
- [8] Frain J.P and Carr, P.H (1996). "Is the Typical Modern House Designed for Future Adaptation for Disabled Older People?" *Age and Aging*, vol. 25 pp.398-401
- [9] Bateman, R., Sarkissian, W., Hurley, B, (2013). Open Space in Medium-Density Housing Guidelines for Planning and Design. Bringing Planning to Life. Nimbin NSW 2480 Australia
- [10] Hartje, S.C. (2005). "Universal design features and product characteristics for kitchen". *Housing and Society*, Vol.32(2), pp. 101-118
- [11] Herd, D., Ward, M. & Seeger, B. (2003). A national strategy for accessible housing for all. Australian Network for Universal Housing Design (ANUHD). Australia
- [12] Iwarsson S & Isacson, A. (1993; 7:155-9). "Basic accessibility in modern housing—a key to problems of care in the domestic Setting". *Scand J. Caring Sci.* Vol 7, pp.155
- [13] Kose, S. (1997). Housing elderly people in Japan. *Ageing International*, 23(3-4), 148-164
- [14] Kyessi, G.A. (2002). Community Participation in Urban Infrastructure Provision: Servicing Informal Settlements in Dar Es Salaam, Tanzania.
- [15] Magina, F. (2011). Accessing Rental Housing by People with Disability in Urban Areas. Unpublished Msc. Dissertation, Ardhi University-Tanzania
- [16] Mboghoina, T. & Osberg, L., (2010). Social Protection of the elderly in Tanzania, Current status and the future possibilities. Research on poverty alleviation. REPOA, Dar es Salaam, Tanzania
- [17] Mohammed, H. A. & Salaiman, S. M. (2006). The Causes and Consequences of Informal Settlements in Zanzibar. A Conference on Shaping the Change.
- [18] Nguluma, H. (2003). Housing Themselves: Transformations, Modernisation and Spatial Qualities in Informal Settlements in Dar es Salaam, Tanzania. Royal Institute of Technology, Stockholm-Sweden
- [19] Olof, H., Bengt, J., Johan, M. & Rasmus, W. (2009). The Complete Guide to Architecture in Stockholm, Kristianstaads Boktryckeri AB, Stockholm
- [20] Sadigh, (2004). "Falls and fall-related injuries among the elderly: a survey of residential-care facilities in a Swedish municipality." *Journal of community health*, Vol.29.2 pp. 129-140
- [21] Sakloglou, P. & Panopoulou, G. (1998). "Who are the poor in Greece? Analysing poverty under alternative concepts of resources and equivalence scales". *Journal of European Social Policy*, 8(3), pp. 213-236
- [22] Sloane, J & Haslam, R. A. (2001). What do older People Know about safety on stairs? *Ageing and Society*. Vol. 21 (6): PP 759-776.
- [23] Stula, S. (2012). Living in Old Age in Europe-Current Developments and Challenges. Working Paper No. 7 of the Observatory for Sociopolitical Developments in Europe
- [24] Vinnitskaya, I. (2013). Developing Adaptable Housing for the Elderly and a Path to Sustainability. *Architectures News Editor's Choice/Arch daily*, USA
- [25] S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, (1999) "A novel ultrathin elevated channel low-temperature poly-Si TFT," *IEEE Electron Device Lett.*, vol. 20, pp. 569-571M.
- [26] Wegmuller, J. P. von der Weid, P. Oberson, and N. Gisin, "High resolution fiber distributed measurements with coherent OFDR," in Proc. ECOC'00, 2000, paper 11.3.4, p. 109.