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Impact of Flexibility on Residential Buildings in Egypt

Aly Mohamed El Husseiny, Azza Ezz Abdelkader

Abstract**—**There is a critical thin line between freedom of choice and randomness. The distance between imagination and perception and between perception and execution varies depending on numerous factors. While in developed areas residents have the opportunity and abilities to build flexible homes, residents in developing areas create their own dwellings in informal settlements, even though none of them is comfortable at home in the long run. This paper explores three factors: What residents really need, what they do with limited flexibility, and what they do when there are no limits, as in the case of informal settlements. This paper studies alteration to residential buildings and how they connect to the changes in people's lifecycle in all past cases. This study also examines all approaches to flexibility, focusing on a social approach. The results of this study are based on three practical studies: Interviews with residents in an informal settlement (Eshash Mahfouz in Minya in Egypt), a civil study of buildings in a middle-class district, and a survey of residents from many countries, including Egypt, and interviews with a number of them to determine residents' needs and the extent of renovations they made or would like to make to their homes.

Keywords**—**Flexibility, housing, freedom of choice, social, changes, residents.

I. Introduction

ARCHITECTS should be anxious regarding delivering suitable designs that estimate the environment and respond to changes according to circumstances [15]. The developed world finds that flexibility in architectural design is an economic solution that aims to make the best of all available built-up spaces. It tries to find alternative construction solutions to help facilitate living for residents. It also intends to increase living opportunities for several social and economic standards and to take full advantage of buildings and construction. William H. Whyte, in his social project "the social life of urban spaces," while observing people's behavior in two plazas in NYC, found that when men sit, they like to have freedom of choice; people move chairs for no reason, in rather pleasant or social circumstances, and just four minutes later they return chairs to their original positions [18]. The ability to choose is an indivisible part of human nature but to what extent that ability should be obtained is questioned.

II. Definitions of Flexibility

The word 'flexibility' means something that is elastic and submissive. In architecture and in housing design, the expression 'flexibility' does not refer to the physical features of matter, which is elastic or hard, but rather to flexibility of the space and the ability to change according to circumstances, needs and purposes [12]. Flexibility can also be defined as a deep-rooted feature, to be capable of adapting according to any motivation. It influences the whole system. Flexibility keeps its main characteristics and reacts to any alteration. Essentially, it means there are two types of components: dynamic and static [16]. Kronenburg defined flexible design in architecture as a design type multi-functional, featuring new methods and significant to today's design problems [10].

III. The Problem

Most developed countries attempted to implement the concept of flexible housing in residential buildings. These buildings did not have the expected changes. Residents did not benefit notably from built-in flexibility for many reasons:

1. Some of the residents just move to a new dwelling when extra space is needed or when they have family changes.
2. Some residents did not know who to contact to benefit from the built-in flexibility.
3. Most owners of rented dwellings do not allow tenants to make changes in the dwellings.
4. Most of the changes that owners make are infill changes. The owners change functions or inner spaces using light walls.

In Egypt, most technologies and approaches to flexibility, such as structural systems, utilities, sustainability, open building, or new facades technologies, are very expensive to be built as mass housing for middle-class residents or low-class residents. The only case in Egypt where flexibility was applied to designs was the case of El-Sadat city. That project failed. Dr. Nassamat, who participated in the initial studies and designs of that project, outlined the causes of that failure as follows:

- Poor management, deficient coordination and conflicts between central government institutions and NC development authorities.
- Poor monitoring, lack of proper/sufficient documentation and continuous assessment.
- Ignoring the original ENC development strategies and related plans.
- Poor housing policies, land allocation and deficient settlement policies [13].

That project was designed under the concept of SAR systems [1]. Different choices in housing solutions at El-Sadat city are shown in Fig. 1.

When low-class residents make changes in their dwellings, they make random changes that damage the visual image of the city. At informal settlements, they make expansions with no limits using poor materials. At formal settlements, they add balconies or change the size of openings, thereby destroying the facades.

Azza Ezz is with the Minya University, Egypt (e-mail: azzaezz40@yahoo.com).

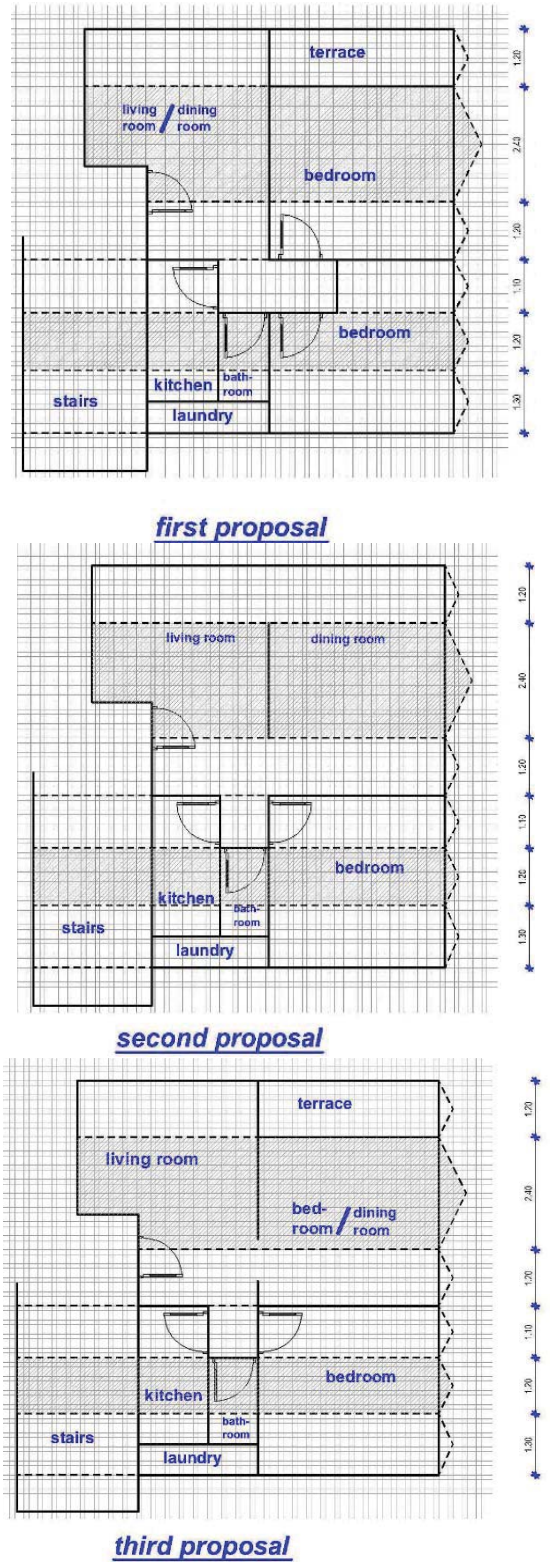

Fig. 1 Flexibility at the area of 57 m^2 [1]

In Egypt, residents do not use light walls when they make changes at the infill, which cause considerable damage and require huge effort. Spaces are mainly designed to be static, contradicting residents' dynamic characters. If old buildings are considered immortal symbols of the magnificence of architecture, that is because they are symbols of the best that one finds in that era. The problem is manifested clearly that what we see on the streets as a visual mess is just a mirror of the contemporary nature that we have become. Buildings express what we are. They are a reflection of our ideology and culture. It is a story of lines affecting the whole of a nation's behavior. Widespread slums are evidence of the disaster we have made and the nature we have become. The problem has been exacerbated and became a huge obstacle to the country's social, economic, environmental, Security and urban development, which has adversely affected urban life in the region, its inhabitants and the whole surrounding areas. The government tries to solve the slum problem in Egypt by moving the residents to new residential buildings far of integrated road networks and external axes, each containing very small apartments. However, these solutions appear to be unreasonable and ineffective. The problem here lies in the lack of clear policy for development, upgrading informal settlements, overlapping specializations and policies in dealing with one region that doesn't allow them to benefit or upgrade. Each family in these slums used to live in a multistory house. The families first build a ground floor on informal land very close to the main road network. Next, when their son gets older and needs a home so he can marry, he builds another floor and continues to expand the dwelling as his family grows. Therefore, taking that away from someone in exchange for very small apartments is unreasonable.

TABLE I
FLEXIBILITY AT THE AREA OF 57 M^2 [1]

Type of flexibility	Flexibility aspects in the proposals
adaptability	• merging the terrace with the master bedroom (first proposal) and expanding it to become a dining room connected to the living room (second proposal) • expanding master bedroom (first proposal) and changing its entrance to be the only room by the lobby (second and third proposals) • minimizing the master bedroom (first proposal) and changing its entrance to be able to be used as a bedroom or dining room (third proposal)
Multi-uses	• changing the living/dining room (first proposal) to a living (second and third proposals) • changing the of the master bedroom (first proposal) to become bedroom/dining (third proposal

IV. LITERATURE REVIEW

There are two methods that respond to residents' changing needs. The first method is making alterations the dwelling such as changing of use, expansions, and envelope alterations. The second method is moving into another dwelling. For moving, there should be multiple choices of places that respond to the different needs of dwellers. Landscape design should also respond to their needs. The main aspect of this solution is to design an engaging environment. Half a century ago, in 1961, N. John Habraken's work, "Supports, an Alternative to Mass Housing," was published, advocating the concept and methods for housing production led by residents. This concept is best applied to the upgrading of apartment house infill [9].

By discussing alterations that have been done to dwellings

in many projects, it can be noticed that there are two main types of renovations besides a resident's ability to donate. The first is the shell that includes variations in the envelope. The second is the infill that includes alterations inside the dwelling without affecting the envelope, such as room size, inner walls, and room function. There are four categories of residents according to types of alterations and the way they behave toward their homes: low class at informal settlements, low class at formal settlements, low class at flexible buildings, and middle class at flexible buildings.

A. Alterations by Low-Class Residents at Informal Settlements

Most transformations and changes done by residents at Hanoi, the capital of Vietnam, are informal building additions and interior renovations. These alterations are the results of poor living standards and lack of space [5]. At Kampung which is an informal settlement in the inner city of Suabaya, adaptations were made at three levels: The settlement level, which includes expansions and change in use; the neighborhood level, joining two dwellings to become one unit so the house could have multiple functions; and the house level, changes made inside the house, such as using partition walls to add more rooms in the boarding house, extending terraces, and opening the roof to provide a balcony [7]. Renovations that occurred at SLT, a small colonial town called Xochimilco to the south of Mexico City, along the years, occurred in many stages and according to the changes in people's life cycle. Changes included vertical and horizontal expansions, façade changes, changes in room sizes and functions, and rooms' exchanges [8].

B. Alterations by Low-Class Residents at Formal Settlements

Changes that occurred at a housing project in Johannesburg, South Africa can be divided into four categories: Changes on site, where residents paved some gardens and changed the colors and tiles of walls and floors; changes in skin, where residents changed the paint of inner spaces, put up thief bars in some cases for safety, and semi-enclosed external spaces; changes in services, where they put up healthy fittings and where they put extra lights; and changes in space, where they used non-loadbearing walls to reduce damage through walls and subdivided spaces to offer more personal sleeping areas [2]. Renovations and expansions done by residents in a district in Japan: That district was built in 1924 on manmade land after an earthquake and the Second World War. Vacant sites were divided into separate zones for additions on case-by-case negotiations between the upper and lower units, and small additions were found to gather vertically. The positions of additions as a whole were little affected by the orientation, while rooms for utilities tended to be added to the north. Rental units tended to expand less than owner-occupied units and such units were mostly found in the upper units of four-family semi-detached houses. [17] In some poor dwellings in a district in China, residents removed some partitions, added individual kitchens, toilets, and a skylight, added insulation and shading, changed windows, and renovated roofs [17]. In Shambat, a city of Khartoum in Sudan, residents made horizontal expansions, divided spaces in the dwelling, changed some utilities, added balconies, and subdivided the courtyard [3].

C. Alterations by Low-Class Residents at Flexible Dwellings

At Hay Hassani, in Casablanca in Morocco, residents made alterations reflecting their own identities. The residents added balconies to afford privacy and to protect themselves from the hot weather. They also put their own touches to highlight their culture and personality. They turned the openings to small ones and painted the dwellings with other colors. They expanded most of the units horizontally. The windows, originally the size of a 'normal' European window, were closed or diminished by the residents, using bricks, wire mesh, curtains or folding shutters [11]. In Pessac, residents partitioned spaces, enclosed patios, covered terraces with pitches roofs, infilled ribbon windows, and repainted surfaces. They considered terraces a wasted space and so enclosed them to expand the space. They exchanged windows with smaller traditional ones to increase privacy and ease of repair [6]. In Previ, residents expanded a house into a three-story structure, including tenant spaces, a small shop, a clinic, and legal offices [6].

D. Alterations by Middle-Class Residents at Flexible Dwellings

At Paerehaven, Fionia house, and M-house in Copenhagen, residents only made alterations in the infill. They changed the functions or sizes of rooms using light walls. At M-House residents installed a transparent wall [14]. Tunnel houses in USA only permit few alterations, compared to flexibility that is meant to happen. Residents made vertical and horizontal expansions and added rooms to their dwellings [4]. The following are changes that were made at public rental housing estates: Fujimidai is located in the western suburb of Tokyo and was constructed in the 1960s. A number of residents expanded their unit by adding spaces on the balcony to the living area. A young couple moved in because they did not need much space. Dwellings that were not changed were occupied by older residents. Residents who occupied units for a long time made improvements to the infill to fit their needs [18]. Alterations made by residents to five projects in the Netherlands: These projects were originally designed to be flexible. The design allowed renovations in the infill. The projects are De Kersentuin case, Multiple choice case, Ecoflex case, La Fenetre case, and Terbregse case. Only at Ecoflex case did residents expanded their dwelling right away. At La Fenetre case residents could not make any changes because the owner did not allow them to.

Figs. 2 and 3 show residents' ability to expand for low-class and middle-class residents. They also show residents' ability to donate. Low-class residents are more able to donate and expand. The designs that are made for middle-class residents mostly follow the OP (open plan) concept. Light walls are

mostly used to make it easy for them to make inner changes. The researcher summarized these changes in Table II. Fig. 4 shows the degree of renovations according to the Table II.

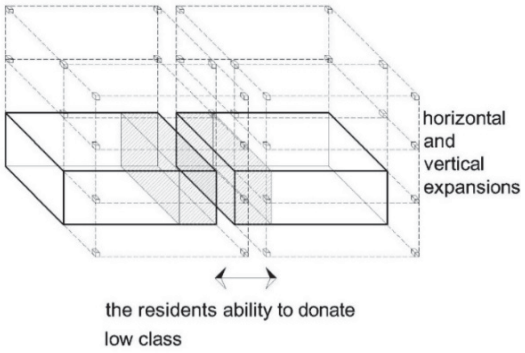

Fig. 2 Low-class residents' ability to donate and expand

E. Approaches to Flexibility

- Construction: The SI housing construction system, Slab-stick Structure System, Matura Infill System, Flexible wall system, and Industrial Flexible Demountable (IFD) building.
- Infrastructure: Pipes in partition walls, and Pipes between double walls. Facades: Double facades, and Movable façade panel.
- Sustainability: open building, and social approach.

V. Methodology

- An interview with residents at an informal settlement (Eshash Mahfouz in Minya in Egypt) discussing their everyday activities and observing the renovations they do to their homes to reach the best housing design program that can fit their needs in the long run.

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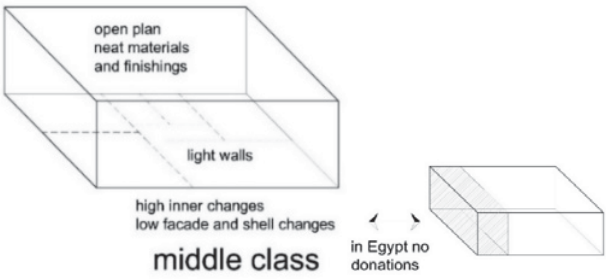

Fig. 3 Middle-class residents' ability to donate and expand

- A civil study of buildings in a middle-class district to discuss several alterations they made to their homes by the time that we observed these alterations and studied them.
- A survey with residents from many countries, including Egypt, and interviewing some of them to determine residents' needs and the degree of renovations they made or would like to make to their homes. Additionally, to test their abilities to donate spaces in their homes and their desire to expand vertically or horizontally.

TABLE II
Matrix Showing Several Renovations Done by Residents

		Shell					**infill**		**donation**
		Horizontal expansion	Vertical expansion	Adding balconies	Façade changes	Room sizes	Inner walls	Room functions	Rooms exchange
Law class at informal settlements	Hanoi in Vietnam	●	●	●	●	●	○	●	●
	Surabaya in Indonesia	●	●	●	●	●	●	●	●
	Xochimilco in Mexico	●	●	○	●	●	○	●	●
	Johannesburg South Africa	○	○	○	●	●	●	○	○
Law class at formal settlements	Japan	●	●	●	●	●	●	●	○
	China	●	●	●	●	●	●	●	○
	Khartum in Sudan	●	○	●	●	●	●	●	○
Flexible building for law class	Casablanca in Morocco	●	●	●	●	●	●	●	○
	Pessac	●	○	●	●	●	●	●	○
	Previ	○	●	○	●	●	●	●	○
	Paerehaven	○	○	○	○	●	●	●	○
	Fionia	○	○	○	○	●	●	●	○
	M-House	○	○	○	●	●	●	●	○
Flexible Design for Middle class residents	Tunnel houses in USA	●	●	●	●	●	●	●	○
	Japan	○	○	●	●	●	●	●	○
	De Kersentuin case	●	○	○	○	●	●	●	○
	Multiple choice case	○	○	○	○	●	●	●	○
	Ecoflex case	●	○	○	○	●	●	●	○
	La Fenetre case	○	○	○	○	○	○	○	○
	Terbregse.nl Case	○	○	○	○	●	●	●	○

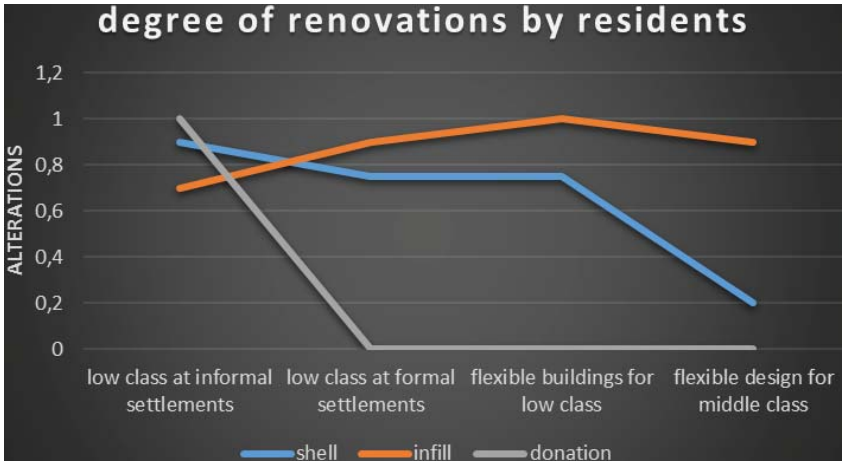

Fig. 4 Degree of renovations by several types of residents

TABLE III
SOCIAL CASE AND DAILY ACTIVITIES FOR THE SIX CASES

rooms	dwellers	Social case	Daily activities
5 rooms and a corridor	5	Married and her husband retired	- All rooms have windows and no balconies - There is a place they call "mandara" at the front of the home. They use it as a meeting place with neighbors, and there is a place for doves and chickens in it. - A television room with three couches in which they gather and eat food in front of the TV, sitting on the floor - Moquette covers the whole home - Parents' room consists of a wardrobe, 2 beds, a couch, and a table - They all sleep in one room
2 rooms	4	Married 70-year-old man	- 2 illiterate girls, 13 and 11 years old - A room contains a cooker, a television, and a washing machine - There is a local toilet under the stairs that leads to the small room upstairs where they keep doves. - At shower time, they boil water using the cooker and use a pan to take a shower in the same room
3 rooms	8	Divorced with three kids, 2 girls and a boy, living at her parent's home with a single brother and a married brother	- A room contains couches and a television where they sit and eat - A room contains a wardrobe and a bed where she sleeps with her kids - A room upstairs where her married brother sleeps with his wife and kids - Her single brother sleeps in the television room with his mother - Under the stairs there is a cooker and a small local toilet with a shower - On the roof, they have doves and chickens
3 rooms	6	Single, lives at her dead parents' home with her married brother and his wife	- She is very concerned about her kids education - She lives in a separate room that contains a television, a wardrobe, and a bed. - There is a toilet and a small kitchen under stairs for her - Upstairs there are two rooms: one for her brother and his wife and a living room where their kids sleep that contains a small local toilet and a small kitchen - On the roof there are chickens
4 rooms	14	Married to a sick man who stays at home, lives with her husband at his parent's home with his married brother and his kids, and with his other brother and his wife	- A room where she lives with her husband and four kids - A room for her husband's parents - A room for her husband's brother who lives in it with his wife and kids - A room for her husband's other brother who lives in it with his wife - A small local toilet with no shower and a small kitchen for all house members - There is no faucet and they use a pan to shower
4 rooms	6	Divorced with two kids, living with her old father and two mentally retarded brothers	- Lives in a house with no ceiling and no television; contains a small carpet - A room for her and her kids, a room for her father, a room for her brothers, the living room for eating and all rooms are open, with no doors - No kitchen and no chickens

A. The Study of Eshash Mahfouz in Minya City

That study was done to determine everyday activities for residents who live in a slum area in Egypt in order to reach a kind of design that responds to their social and spatial needs in the long run. The researcher discussed six cases. Table III shows the social case and daily activities for the six cases. Table IV shows a time schedule for dwellers' activities along the day at the area of Eshash Mahfouz in Minia city.

Table V shows dwellers' outdoor activities at the surveyed area of Eshash Mahfouz in Minia. Table VI displays a proposal for the design Program to be implemented for each unit based on the data extracted from the survey.

Most of the dwellers said that it is preferred to use the roof for keeping chickens and doves. The home should be prepared for vertical extensions and each family owns their own house. The compound should contain a green area, playgrounds for kids, a supermarket, an Internet café, a restaurant for local sandwiches and food, a bus station, a hospital, and a social club.

TABLE IV
TIME SCHEDULE FOR THEIR ACTIVITIES

	5-6	Waking up
For elderly and adults	6-6:30	Feeding doves and chickens
	6:30-7	Getting breakfast from outside
	7-8	Going to work
	15-16	Coming back home
	16-17	Making food and eating
	17-21	Arranging the home and having tea in front of the home; watching streets and kids playing; some women stay at home and some men go to sit in a café
	21-22	Time to sleep
For kids	6-7	Waking up
	7-8	Going to school
	14-15	Coming back from school
	16-17	Lunch time
	17-19	Study time
	19-21	Playing in the street
	21-22	Time to sleep

TABLE V
OUTDOOR ACTIVITIES

Men	Sitting in a café, drinking tea and smoking hookah, playing backgammon; some people have small markets they stay there along the day
Women	They do not have activities in the streets, they only get breakfast from outside in the morning
Kids	They play hide and seek in the streets and other street games; they buy small games and snacks

TABLE VI
DESIGN PROGRAM FOR THE UNIT

A living room	16 m^2
Two rooms for each family	18 m^2
A bathroom	3 m^2
A kitchen	8 m^2
A corridor	2 m^2
A terrace	8 m^2

B. A Study of a Middle-Class District at Minya City

It was undertaken to discuss changes to residential buildings for middle-class residents in the long run, discussing their social needs and behaviors. Fig. 5 was taken in a residential compound for university professors' families in El-Minya City. Changes that were noticed:

- Most balconies were added to the units
- Many residents added air conditioning to their homes
- Windows are mostly closed. Residents open the window glass from inside and close the wooden window covering to let air through the home and to guarantee privacy
- Inside the units most dwellers expanded their living area by adding a room to it to fit their needs and furniture
- By asking residents why most of them added balconies or did not open them, they gave several reasons:

1. The hot weather
2. Lack of space
3. They said the blocks were so close to each other that they do not afford privacy
4. Bad and ugly views

Fig. 5 Changes to a residential building for middle-class residents in Minia City

C. The Survey (Discussing Residents' Mindsets in Being Flexible or Not)

This survey tested residents' ability to change and adapt which, in turn, will affect the criteria of designing homes. Research samples were chosen from 13 different countries, as the following chart indicates.

D. Sample Analysis

1. In Egypt

307 dwellers were interviewed. Two standards of living are medium class who are highly educated and low standard with low educational level.

2. In Other Countries

The researcher contacted the residents by email and interviewed some of them: 20 from Canada, 31 from China, 23 from Europe, 12 from Japan, 9 from Malaysia, 16 from Russia, and 53 from the USA.

Standards of living are medium and all the samples are highly educated and academic people who work as professors at universities in their countries.

E. Renovation Degree

Fig. 6 shows the degree of renovations that dwellers made to their homes in each country.

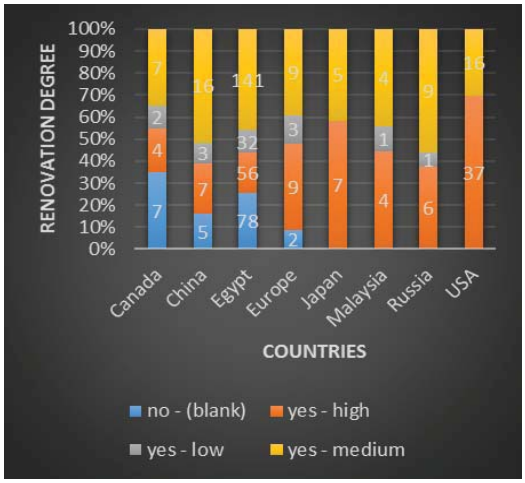

Fig. 6 The degree of renovations that dwellers made to their homes in each country

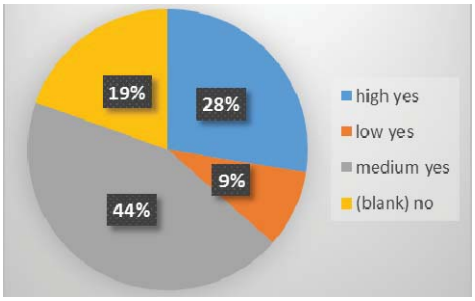

Fig. 7 General percentages of renovation degree

By surveying the percentage of renovations that dwellers performed, it is of note that 28% of units were highly renovated while only 9% had low renovations. Other renovation degrees were 44% for medium renovations and 19% of units had no renovations at all. It is immediately apparent that the overall trend for residents is to make different alterations to the units. There was a substantial increase in the number of dwellers who made medium renovations.

F. Dwellers' Ability to Donate

Fig. 8 shows family members' ability to donate a room to one member of the family.

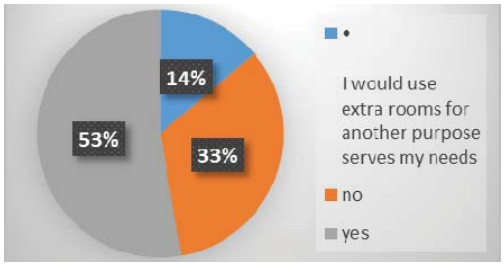

Fig. 8 Family members' ability to donate a room to one of the family

33% of the total sample refused the idea, 53% said yes and 14% refuse to donate, as they would use extra space for reasons that afford their needs.

Fig. 9, shows family members' ability to donate a room to one of the family, showing the percentage in each country and comparing the results.

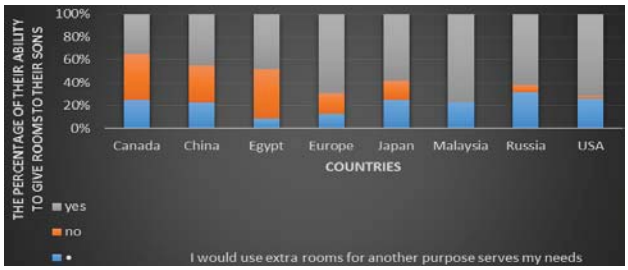

Fig. 9 Family members' ability to donate a room to one of the family showing the percentage in each country

As is observed, the figure for room donations among families in the eight countries shows a considerable decrease in Egypt. The highest renovation percentage is located in Malaysia. The ability to donate arranged in order: Malaysia, USA, Russia, Europe, Japan, Egypt, China, and Canada.

Fig. 10 shows residents' ability to donate a room to a next-door neighbor. This question was asked for two reasons:

- To test residents' ability to donate and to change as well.
- To test the degree of success of a certain kind of design built after world wars as a solution to mass housing designed by Habraken. It is mainly based on peoples' ability to change and donate. It was built in most of the countries that faced world war mass disasters.

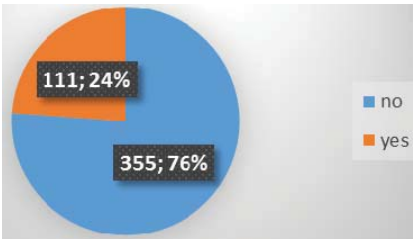

Fig. 10 Resident's ability to donate a room to a next-door neighbor

24% of total sample accepted while the majority of 76% refused. Fig. 11 shows the percentage of resident's ability to sell a room to a next-door neighbor, comparing the results in several countries.

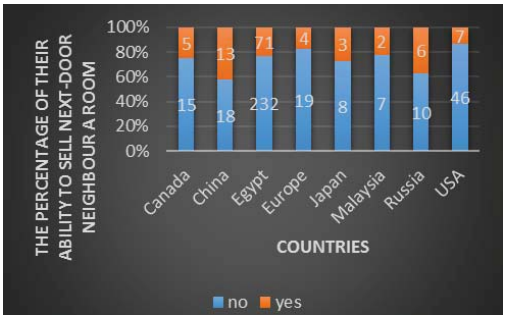

Fig. 11 The percentage of residents' ability to sell a room to a next-door neighbor

Fig. 12 shows the percentage of residents' ability to sell a room to their sons.

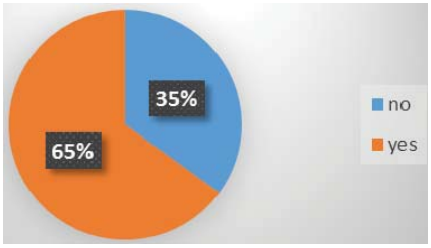

Fig. 12 The percentage of residents' ability to sell a room to their sons

The give pie chart represents the percentages of residents' ability to sell rooms to their sons. 35% of residents who said no refused the whole idea while 65% confirmed.

Fig. 13 shows the percentage of residents' ability to sell a room to their sons, comparing the results in several countries.

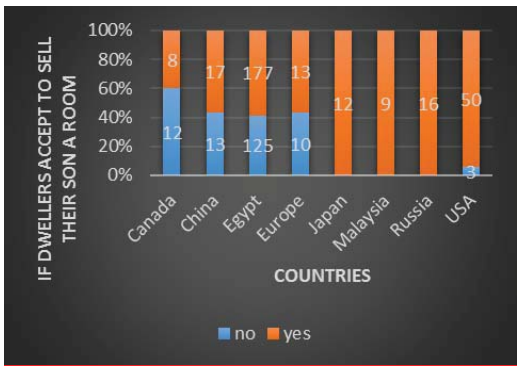

Fig. 13 The percentage of residents' ability to sell a room to their sons among countries

In Egypt the percentage looks convergent. All residents in Japan, Malaysia, and Russia who answered that question accepted the idea of giving a room to their son. In the USA, most of them also said yes.

F. Expansion Preferences

Fig. 14 shows residents' desire to expand vertically or horizontally.

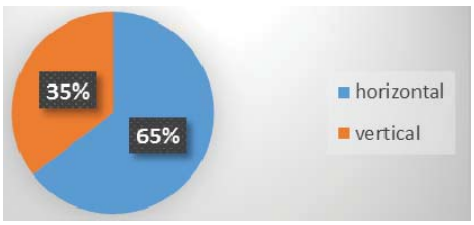

Fig. 14 Residents' desire to expand vertically or horizontally

65% wanted to expand horizontally. 35% wanted to expand vertically. Fig. 15 shows residents' desire to expand vertically or horizontally, comparing the results in countries.

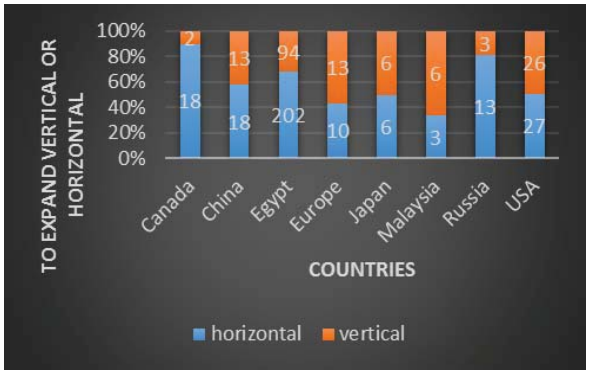

Fig. 15 Residents' desire to expand vertically or horizontally, comparing the results in countries

Fig. 16 shows how residents would prefer their home to be (large, medium, or small) if they were getting married and starting their life.

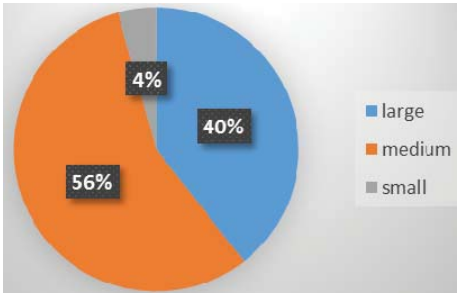

Fig. 16 Residents' preference of their home to be (large, medium, or small).

The majority of them liked their home to be medium, 40% wanted it large, and only 4% wanted to start their life in a small home. That result shows the lesser ability to be flexible.

G. Home Size Preferences:

Fig. 17 shows how residents would prefer their home to be (large, medium, or small) comparing the results among countries.

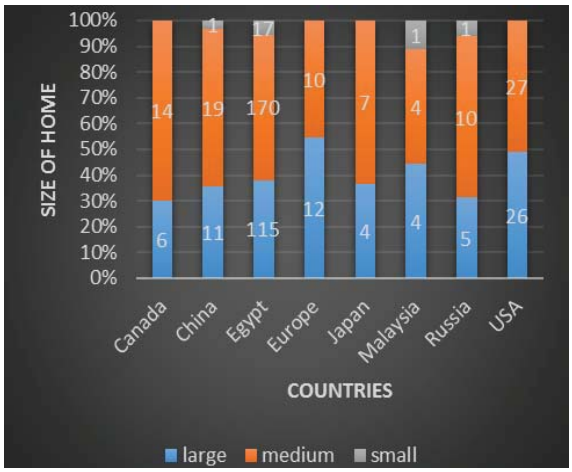

Fig. 17 Residents' preference of their home to be (large, medium, or small).

H. Number of Rooms

Fig. 18 shows the optimum number of rooms that residents would like to have. It is related to flexibility, as the more rooms they prefer to have, the less they are ready to accept being flexible and to change the uses of spaces.

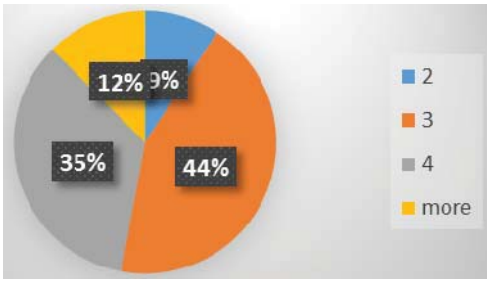

Fig. 18 Number of rooms: 9%: 2 rooms, 12%: more than 4 rooms, 35%: 4 rooms, 44%: 3 rooms

Fig. 19, compares residents' preferences of the number of rooms among countries:

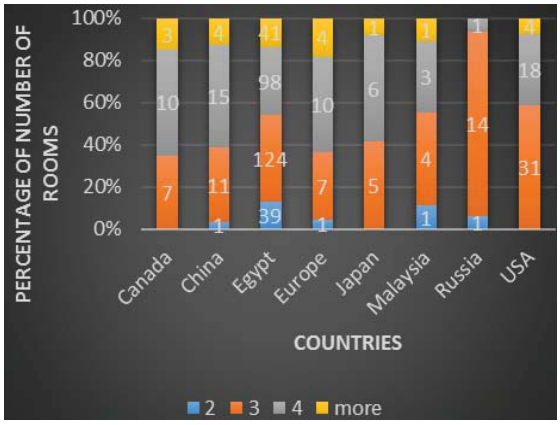

Fig. 19 Number of rooms among countries

I. Flexibility as a State of Mind

If residents need extra space at home, they either move to a bigger home or expand their current unit. Fig. 20 shows their preferences to move or to expand. It measures flexibility as a state of mind.

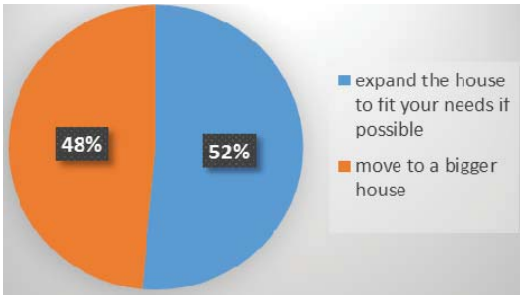

Fig. 20 Residents' need of extra space, would they move or expand their house: 52%: preferred to expand the house; 48%: preferred to move to a bigger house

Fig. 21 shows if residents need extra space, would they prefer to move or to expand their house, comparing the results among countries:

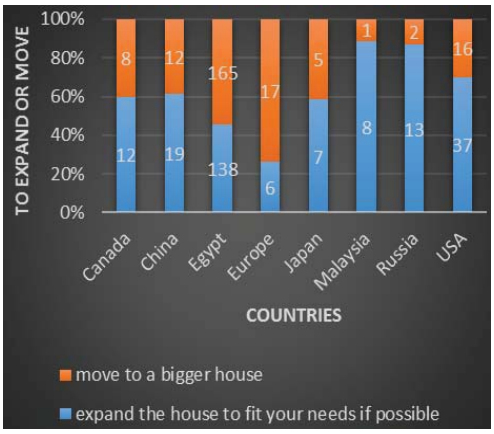

Fig. 21 Resident's preference to expand or to move, comparing the results among countries

In Egypt the percentage looks convergent. In the USA, Russia, and Malaysia, most residents chose to expand rather than move. In Europe most of them chose to move rather than expand. In Japan, China, and Canada, the percentage of residents who chose to expand is slightly higher.

J. Degree of Attachment and Territoriality

Fig. 22 shows if residents would like to move from their city to a nicer place. It shows a readiness to change and the degree of attachment and territoriality

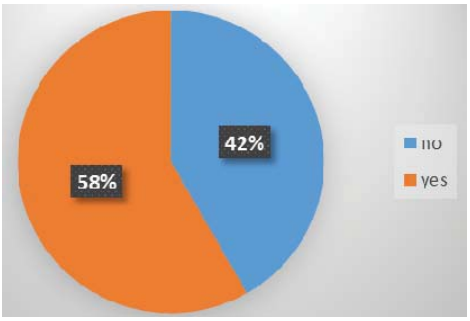

Fig. 22 Residents' preference to move from their home to a nicer place: 42%: did not like to move from their city to a nicer place; 58%: liked to move to a nicer place

Fig. 23 shows if residents would like to move from their city to a nicer place, comparing the results among countries.

The highest percentage of 'no' was found in Egypt, which shows that the degree of attachment and territoriality in Egypt is high; even the two percentages of yes and no were convergent. Russia is similar to Egypt. Other countries' ability to move is much greater. Fig. 24 shows residents' ability to move in late age to a smaller apartment, leaving the home to their sons.

Fig. 25 shows residents' ability to move in late age to a smaller apartment, leaving their home to their sons, comparing the results among countries. Fig. 26 shows if residents have extra space in their home, are they ready to move to a smaller

one or not.

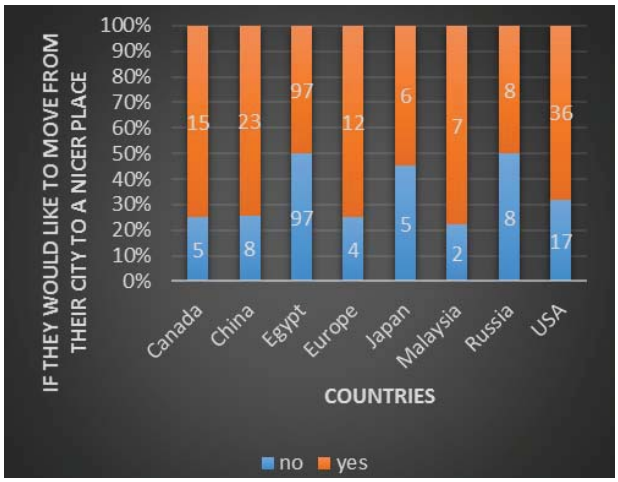

Fig. 23 Residents' preference to move from their city to a nicer place, comparing the results among countries

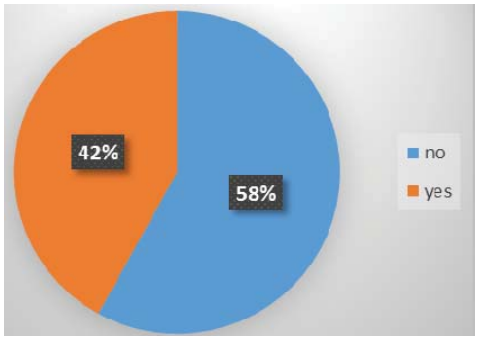

Fig. 24 Residents' ability to move in late age to a smaller apartment, leaving the home to their sons: 58% to move in late age to leave their home to their sons, 42% accepted

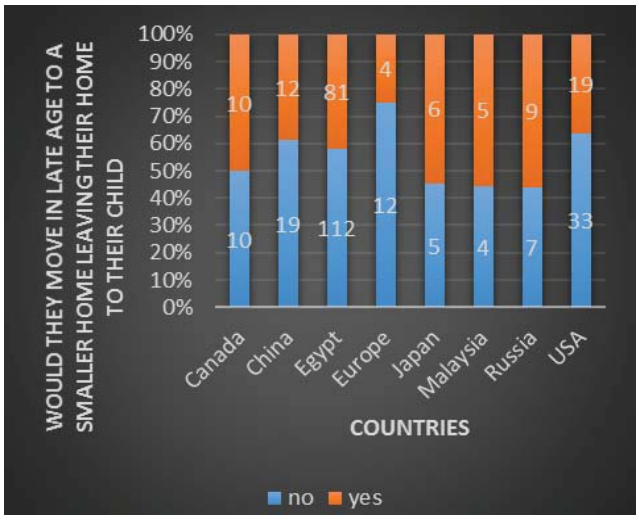

Fig. 25 Residents' ability to move in late age to a smaller apartment, leaving the home to their sons, comparing the results among countries

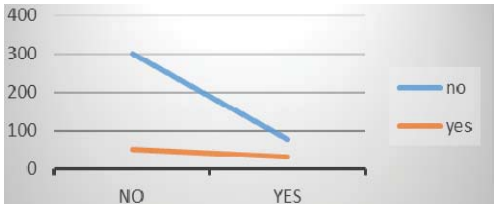

Fig. 26 Residents having extra space in their home, are they ready to move to a smaller one or not: 21%: yes, 79%: no

Fig. 27 shows if residents have extra space in their home, are they ready to move to a smaller one or not, comparing the results between countries.

Fig. 27 is associated with Fig. 26 and the results are very similar. Fig. 28 shows residents' ability to move through a lifetime to different homes:

Fig. 29 shows residents' ability to move through a lifetime to different homes, comparing the results between countries.

Fig. 30 shows residents' ability to live in an elderly house care when they get old. Fig. 31 shows residents' ability to live in an elderly house care when they get old, comparing results between countries. This question seemed to be socially unaccepted. People who were interviewed when they heard that question said a sharp 'no'.

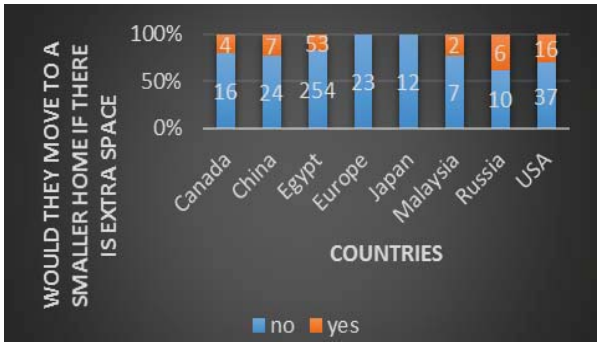

Fig. 27 Residents' in cases of having extra space in their home, being they ready to move to a smaller one or not, comparing the results between countries

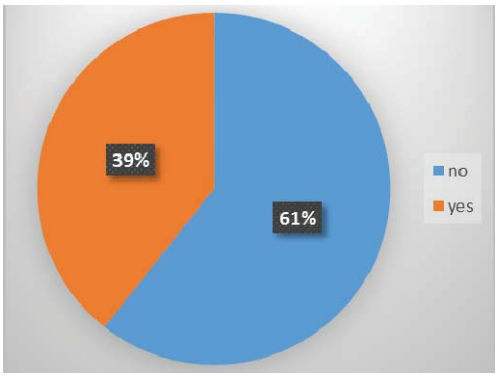

Fig. 28 Residents' ability to move through a lifetime to different homes: 61%: no, 39%: yes

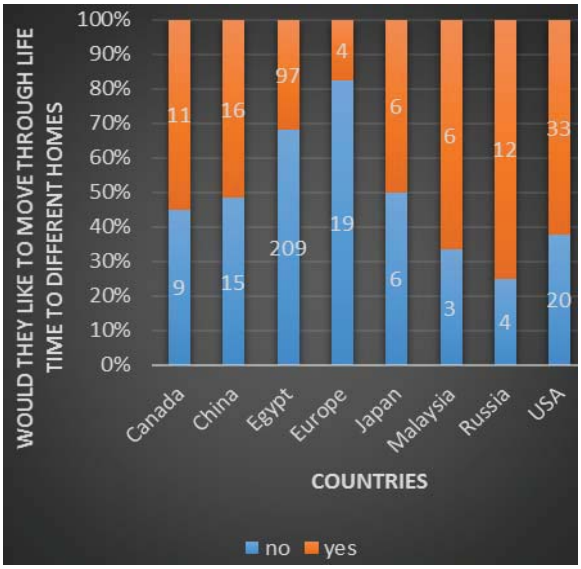

Fig. 29 Residents' ability to move through a lifetime to different homes, comparing the results between countries

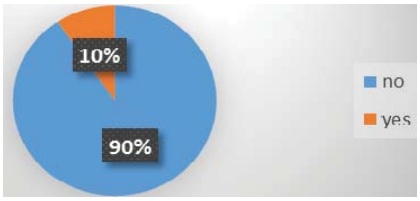

Fig. 30 Residents' ability to live in an elderly house care when they get old: 90%: no, 10%: yes

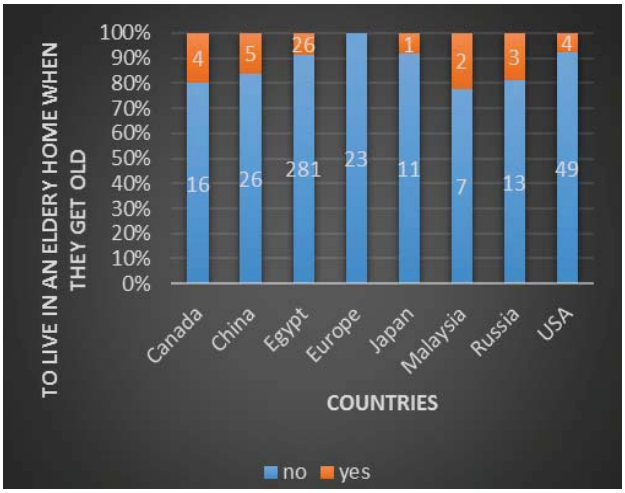

Fig. 31 Residents' ability to live in an elderly house care when they get old, comparing results between countries

K. Survey Discussion

In Egypt, the percentage of owned dwellings is considerably higher than that of rented ones. The percentage of owned dwellings in China and Europe is close to the percentage in Egypt. In Russia, the percentage of rented dwellings is higher than the percentage of owned ones. In other countries, in the USA, Malaysia, Canada, and Japan, the percentage is convergent.

The highest percentage of owned dwellings refers to the least ability to move. The highest percentage of rented dwellings refers to the ability to move and change.

The prices of rented and owned homes in the same middle standard of living in Egypt is higher than it is in the USA, Europe, Japan, Malaysia, and Russia, although dwellings in these countries are much better in quality and surrounding environment.

The highest renovation degree is located in the USA. Renovation degree arranged from high to low: USA, Japan, Russia, Malaysia, Europe, China, Egypt, and Canada.

33% of the total sample refused the idea to donate a room to a family member, 53% said yes and 14% of them refused to donate, as they would use the extra space for reasons commensurate with their needs. The lowest family ability to donate is in Egypt. The highest is in Malaysia. The ability to donate arranged in order: Malaysia, USA, Russia, Europe, Japan, Egypt, China, Canada.

In Egypt, in the interview dwellers were frustrated with the idea of selling their son a room and most of them said that they would not do it unless their son was badly in need of these rooms, which would not be a permanent arrangement as well. In discussing residents' ability to donate a room to a next-door neighbor, this question was asked for two reasons:

- To test residents' ability to donate and to change as well
- To test the degree of success of a certain kind of design built after world wars as a solution to mass housing designed by Habraken. It is mainly based on peoples' ability to change and donate. It was built in most of the countries that faced world war mass disasters.

Twenty-four percent of the total sample accepted, while the majority (76%) refused. Most residents in the interviews did not accept the whole idea.

1. About Prices in the USA:

An Egyptian student who lives in Arkansas said that most Arab or African residents who live in the USA for academic reasons or for work live in poor neighborhoods that cost them less than $300. When an American resident from Florida heard the cost of $300, he said the residents must be from the ghetto, which where African residents live. Most Arab residents live in cheap places there to save money, even if they have a family and children. Most Arab students live in cheap places, too.

2. Renting and Exchanging in the USA:

Americans love to live in houses, rather than apartments. They would rather rent a room in a house than an apartment. They do not like close neighbors. Renting a room in a house is very popular.

3. Renovations in the USA:

An American resident in Arkansas said that most residents first live in a one-bedroom apartment or house. Next, when these residents have a baby, they move to a larger home, and then they have another and move again as needed. They cannot make changes in the house unless they own it. Horizontal expansions depend on the house, if it has a yard or

not, and if you are allowed to expand or not. She has not seen expansions before. Most residents change the functions of rooms. If there is a small storage room, it could be someone's bedroom. There are many programs that are concerned with inner changes in function and space to fit a resident's needs. They remove walls to expand some rooms and decrease the area of other rooms. They try to use the basement. They mostly change the inner usage to get the most use of it. HGTV channel shows many programs about renovations. An architecture professor in a university in the USA was interviewed and said that in most of the residential buildings that were designed to respond to residents' basic needs in the long run after the disaster of static mass housing designs, residents did not make any changes that were in the main design. Residents are willing to renovate but not to donate. They did not expand their homes by buying a room from a next-door neighbor. They just moved to bigger houses when they needed extra spaces.

Even if most residents refused to sell a room to a neighbor, most of them accepted to sell it to their son. In the interview with residents in Egypt, the answers were contradicted. Some said they would give it for free and others said "no, he can get or built a new home". Those answers are obvious in the chart, as in Egypt the percentage looks convergent. All residents in Japan, Malaysia, and Russia accepted the idea of giving a room to their son. In the USA also, most of them said yes. In these countries, residents' ability to change and donate is higher than other countries that their results looked convergent.

In Egypt, when asking residents if they would like to expand horizontally or vertically, some residents at first said "is that possible, to expand horizontally?" They were glad with the idea because the widespread cases there are vertical expansions and they could only expand horizontally by adding a balcony. In some of the informal settlements in Egypt, residents build a home on a very small space, approximately 25 m2, and add vertical rooms in time to accommodate their needs.

The majority of them liked their home to be medium, 40% wanted it large, and only 4% wanted to start their life in a small home. That result shows their lesser ability to be flexible.

During interviews, the concept of small, medium, or large homes differed from one resident to other. A home with two rooms, for example, was considered large for some residents and too small for others. Residents like big or medium spaces and do not like small spaces, so they are not willing to start with a small one and to expand it according their needs. Most residents want homes with three or four rooms, which means that this number of rooms is satisfying and corresponds to their needs.

In the USA, Russia, and Malaysia, most residents chose to expand rather than move. In Europe, most of them chose to move rather than expand their homes. In Japan, China, and Canada, the percentage of dwellers who chose to expand is slightly higher.

The degree of attachment and territoriality in Egypt is high. Russia is similar to Egypt. Other countries' ability to move is much greater.

In Egypt, in most of the cases when sons or daughters get married, they consider their parents' home to be a family home and return once in a while with their children to stay perhaps for days or months if their daughter has recently given birth. In interviews, some residents said they would need extra space, not less space.

Some residents would consider giving their son the dwelling with extra space if he needed it, but to leave it for no reason was mostly unacceptable to them.

Residents in Egypt mostly do not understand the definition of flexibility or sustainability. Homes are mostly designed as a matter of inherited habits, rather than as a means of satisfying their real needs.

VI. Conclusions

The problem in Egypt can be observed in the whole system, beginning with authorities, residents, and all participants in the building process, including designers, contractors, and laborers. When project plans were designed to respond to residents' changing long-term needs, as in the El-Sadat city project, the project did not have the expected success because of its many problems, most importantly poor management and monitoring.

In slums, residents build their own homes. Those dwellings respond to their basic needs of having a home or a shelter to live in. The dwellings also allow expansions in the long run, but they lack the basic factors for being healthy homes. Units in slum areas face major issues in plumbing, infrastructure, construction, and the small total area of space. The residents design one room for each family. It is the room where they sleep, eat, and cook. They expand the house by adding a room upstairs to enable one male family member to get married in, where the same disaster of using one room for all of life's activities is repeated. Although that lifestyle causes many social and psychological problems for slum residents, they prefer living there rather than living in the units given to them by the government, which can be called "planning and design failure".

The word 'home' in Egypt is understood as a financial property, rather than a social concept. Dwellers exploit every empty space to be added to the house or used for trade. In middle-class areas also the home is treated the same way. Residents do not get spaces that respond only to their needs. They love the word "space". They add spaces as much as they can. This means "luxury" for them. Many residents add balconies to expand the reception area even if they basically do not need that space or have the furniture to put in it. It just expresses luxury for them. The design is not so important for residents as long as the dwelling is located in a good place. "Good" means a place where the one meter costs a great deal of money or looks over the main streets or is near a good region. They do not care if the apartment plans or facades look nice or if the streets and landscape are good. Many dwellers reduce the width of walls to add space to the dwelling, as every meter costs them money. It is treated as a property away

from the main needs and uses of the dwelling. The government also addresses dwellings as a financial property. "More units", "Less costs", and "More prices" are the concepts followed by all participants in the process.

VII. Recommended Solutions

1. All participants, including authorities, designers, and residents, have to work together to solve the problem. One factor would not succeed without the others. They must be mixed together.
2. The "laws" and residents' needs should work together at all stages of the process, starting with the main plans.
3. Residents should address the home as a small part of society that forms the whole district, which in turn forms the whole country.
4. To have a flexible place and address it as a dynamic space, one should have a flexible mind first, one that knows one's basic needs and roles exactly. To have a beautiful and comfortable home, one should appreciate beauty first and should such as to enjoy it. If the government built a million units with the best design ever for residents with inflexible mentalities in a middle-class area, those dwellings would not have the expected changes, would not be dealt with as dynamic spaces, and the facades would be corrupted by messy changes. If they were built in a low-class area, they would turn to slums.
5. The government can embrace another, cheaper structure in residential buildings with neat finishing that meets residents' needs socially, culturally and economically, such as wooden houses instead of concrete ones.
6. The government could make codes to the degree of neatness for finishing.
7. The government could also begin awareness campaigns to inform people about the importance of flexibility in the long run.
8. The laws should be enforced.
9. Laws should also go along with peoples' needs.
10. The Ministry of Housing should embrace the concept of flexibility in terms of housing.
11. Residents, architects, and contractors should be aware of the new technologies that embrace the concept of flexibility in residential buildings to meet residents' long-term needs.
12. The design should take into account all indoor and outdoor activities in the long run.
13. New housing designs should be flexible.

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