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Strategies of Adaptability: An Approach for Affordable Housing Design

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ABSTRACT

Designing affordable housing needs efficient strategies in order to reduce costs without affecting housing adequacy. Accordingly, this paper tries to clarify the potential of adaptability strategies for affordable housing design. These strategies provide the ability of housing for merge, division, growth, and changing uses but in a minimum physical way. It is acknowledged that designing adaptability is an important approach for designing sustainable housing environment, because adaptability strategies are considered as social, environmental and economic concepts. Such strategies enhance the ability of housing to adapt different needs of users through the time. Therefore this paper analyzes strategies of designing adaptable housing and their suitability for affordable housing design. To do so, three values of designing affordability are chosen: decreasing the area of housing-unit, decreasing the amount of building materials, and simplicity of implementing methods. Thus, the paper highlights the potential of adaptability strategies for achieving the previous values. We will use the SWOT analysis method in order to highlight strengths, weaknesses, opportunities and threats of the adaptability strategies in terms of affordability values. The paper concludes that adaptability is a high potential approach for affordable housing design, because it could provide many positive results. Therefore, the proposed control of strategies and recommendations of this paper may assist designers in enhancing opportunities and reducing weaknesses and threats of adaptability strategies in order to maintain values of affordable housing design in their projects.

Key words: Affordable housing, Housing design, Adaptability strategies, SWOT analyses

INTRODUCTION

Affordable housing should not be described as low-cost housing, because low-cost housing may lead to poor quality of buildings such as inadequate space area or poor building materials. Low-cost housing will also increase indirectly the monthly payment of living for the householders. For example: low efficiency of building materials will increase the bills of electricity, gas, and maintenance, not to mention the bad effects of poor designs and materials on the resident's health, and the surrounding environment [1]. This fact makes reducing the costs of housing a serious problem. Such problems lead to the importance of finding creative solutions of design that decrease the costs of housing without affecting its qualities. For that reason, one of the most important global problems facing architects today is how to design adequate but affordable housing¹. This means that designing housing should be at reasonable prices which correspond with the income of users while not compromising the quality of housing: environmental and social. It is acknowledged that good architectural design and proper planning of housing are very important factors to reduce the cost², towards affordability inside of low-costing.

Accordingly, there is a need to examine some creative strategies of designing affordable housing. Hence, the role of the architect in designing for affordability is to keep looking for strategies that make balance between the cost of housing and other environmental and social qualities. In other words, it is vital to introduce successful strategies of designing

¹To give an indication of the rapid increasing of housing cost related to house family income, in US for example; more than 25% of Americans-including 85% of Poor households) spent more than 30% of their incomes on housing, this is now called housing affordability problems[15]

² Good design of housing must always consider economic factors, it is a fact that seventy percent of the cost of a new dwelling is affected by planning and design decisions[14]

adequate housing that decrease consumption of land, energy, and construction materials. In addition, strategies of affordable housing design should be based on Low-Tec solutions [2]. Therefore the aim of this paper is to discuss such Low-Tec strategies of housing design: Adaptability in specific.

The design for adaptability is an important approach of designing affordable and sustainable housing, because it is based on finding strategies that facilitate adapting the building through the time with minimum changes by using simple tools, which reduce the running costs of the building³[3]. Besides, the idea of adaptable housing is in general Low-Tec idea, as adaptable houses should have simple plan form and straightforward construction methods in order to conserve economic values [4]. In addition, there is a correlation between the ability of housing for change and the need for sustainable design, since it is a good way for reducing the consumption of construction materials, energy, and land both on the short and long terms. The design for adaptability aims also at providing maximum satisfaction for users through the time, because adaptability responds to the human need for change while expecting limited changes of the built environment, which encourages positive behaviour [5]. As a result, designing for adaptability could be a strategic approach for affordable and sustainable housing in terms of economic, environmental, and social benefits.

Many strategies of adaptability can be used for affordable housing design, such as: the ability of housing for merge, division, growth, changing use, and multiuse⁴. These strategies can provide direct or indirect economic, social, and environmental benefits for the residents. However, adaptable housing is required to be flexible, which may suggest some restrictions on implementing methods and thus will increase the cost of housing [3]. Because of that, strategies of adaptability should be studied in terms of economic values, as the exaggeration of the design for adaptability may not be the best choice, it should take only the expected need of family members for adaptability in the account [6]. Thus, we will discuss adaptability strategies of housing design in terms of their suitability for the design of affordable housing. As the aim of affordable design is to reduce the cost of housing in the short and long terms without affecting housing adequacy. In order to achieve the objectives of this paper, the following values will be emphasized in the design of affordable housing: reducing housing area, reducing the amount of materials used in construction and finishes, and facilitating the implementation of the design. Therefore we will discuss the strategies of adaptability and their ability for maintaining the previous values.

ABILITY FOR MERGE

The ability for merge is a strategy of creating spaces which are able for merge in order to facilitate transformation of the spaces and the whole built environment into different organism through time [7]. This means that two spaces or more are designed in a way that allows for merging them into one space in the future. This strategy may assist in changing the use of the spaces into another one that requires much area. Usually a temporary partition between these spaces is used in order to have the opportunity for removing it in an easy way. In a spatial design wise, the ability of the space to be merged with another may require spatial attention for the openings, the distribution of furniture, and the relation of spaces with other parts of the house in both cases (before and after merging). The ability for merging can also be designed for the scale of houses units. The ability of two or more small units to be merged in one unit may facilitate the future growing for the household's members and provide them much space according to the need⁵. This may require a special thinking of spatial design for more than one scenario: for example the ability of the same area to be designed for one large unit or two small independent units should suggest suitable design for entrances, sanitation, and utilities.

This strategy has potentials for designing affordable housing for both scales: space, and unit. On the space scale, the ability of merging will not reduce the area of the house in a direct way. However, it may assist in increasing the number of rooms in the short term, as it is possible to obtain a larger room by merging two adjacent ones in the future if needed. In addition this strategy may slightly increase the amount of building materials in the short term by using some partitions between rooms designed to be removed in the future. On the unit's scale, this strategy can decrease the required area of the house for a small family in the short term by providing relatively small units. However, in the long term the area will increase by merging with other spaces or units according to the future need of the family. When the required area is reduced, and the small unit area is designed for the short term, this will reflect positively on the consummation of the building and finishing materials in the short term.

ABILITY FOR DIVISION

The ability for division is a reverse strategy of adaptability compared to the previous one. It consists in designing one large space that is flexible to be divided into two spaces –or more- in the future according to the need. This division can be permanent or temporary: the permanent division is the use of fixed walls or partitions, while the temporary is the use of flexible ones. The flexible division is reversible; it may indicate a continuous need for several division and space merging. In this sense, many designs of adaptable houses suggest the use of simple sliding screens for example, which will obtain a maximum flexibility of the house to divide and merge interior spaces according to the need [4]. In order to

³This approach was emerged in the modern architecture in providing post-war housing in Europe. It was based on innovative thinking of housing design, which made the idea of adaptability and flexibility be attached with affordable and low-cost housing until now [13].

⁴Adaptability can be used as a term for further abilities of the house such as adapting climate change [12], and adapting needs of disabled members of the house [6].

⁵Ability for merge highly influenced by housing type; row houses for example are much able for merging units compare to Simi-attached housing [6].

obtain successful results of division, this strategy requires conceding the success of both solutions in terms of relations with other spaces of the house, as well as relations between equipment's inside these spaces.

This strategy is a potential approach of affordable housing design. Ability for division decreases the used materials of construction and finishing only on the short term. Although the required cost of creating this ability—with certain developments on the plan—can be neglected [4], the ability of spaces for division is a strategy that unlikely decreases the area of the house both on the short and long terms as it provides a solution for changing the spatial design, and increasing the number of rooms but not managing the consummation of land. However, on the unit scale, this strategy can decrease the consummation of land and building materials on the long term, if used for providing new independent units without the need of constructing them from the beginning. This strategy can be useful for large families supposed to be divided in the future as its members intend to move to other housing units. But until the need for this division, inefficient use of the large unit can occur, especially if this unit is occupied by small families from the beginning.

ABILITY FOR GROWTH

The ability for growth for a space means to be able to extend in the future outside of the current outline of the house. This strategy may require unused outdoor spaces for the growth of ground floors, and terraces for the growth of upper floors. These outdoor spaces should be designed from the beginning to be used in the future for this extension. In other words, the ability for growth can be described as a gradual building of the house in order to increase the efficiency of using the spaces according to the need. It was described by [8] as the “growing process”. This strategy offers the extension of a certain space; bedrooms for example to fit the increasing number of children, or the scale of housing units by adding new bedrooms to fit the future number of the family.

This strategy includes many potentials for affordable housing design. It can decrease the required area of the house in the short term in order to have the programmed extension in the future, which may suggest some restrictions on building methods to facilitate this extension. However, this strategy may face some threats in the long term, because some of the outdoor spaces are designed to be used as an extension to the interior space of the housing unit, which may lead to some of those spaces not efficiently used in the short term. However, the efficiency of using building materials and construction methods will increase in an indirect way on the long term, as unused structures are limited. But on the short term, some exterior walls have to be built to be demolished in the growing plan. The fact is that it is difficult to build temporary exterior walls to be reused without referring to expensive building technologies⁶.

ABILITY FOR CHANGING USE

The ability for changing the use is another strategy of adaptable housing that can be applied both on the scale of the space and on the scale of housing unit. This is a vital strategy, because the future need of the householders is not always connected to the increase of the householder's members, it is in many times connected to changing their use of the space. In addition, the householders of the house may move to another house and other householders with other needs and wants may occupy the same house, which make this strategy a vital one for an adaptable housing [9]. For example the need for a guest room in the primary design of the house may be changed in the future according to family relations with friends and neighbors. Thus, the ability for changing the use of this room may recommend other suitable activity for the same space such as office or studying room, which guarantees the efficient use of spaces on both short and long terms. Another example of the need for changing the use could be on the scale of the housing unit and not only on a specific space of the house. The householders may decide to invest in their unit a different function rather than family housing. This need may be facilitated by the location of this unit and its potential for different uses. Thus, it's important in this case for the housing unit to adapt changing for other uses such as: office, bed and breakfast, and so on.

The potentials of these strategies for affordable housing design provide a limitation of physical changes. These strategies usually rely on the minimum changing of spatial design, which can decrease the required building materials and construction costs for making this change on the long term. Consequently, planning for these changes from the beginning will decrease the need for demolishing and rebuilding in the future; on the one hand, this does not make this strategy useful in terms of decreasing the housing area in a direct way, and on the other, this may lead to an indirect way of restriction on the spatial design of the house. This is because it may illuminate the need for the growth of the house or merging it with other units in order to fulfill future uses. In addition, this ability may also face strict on finishing materials and furniture types in order to meet the suggested uses in the future. However, the ability for changing the use of space and units can reflect positively on the householder's income which may be considered as an indirect way of achieving goals of affordable housing design.

ABILITY OF MULTIUSE

The ability of multiuse in the scale of a space can be seen as merging more than one use in the same space⁷. For example, the dining room can be used as a studying room in different moments of the day and night⁸. This strategy is based on the maximum efficiency of using the space in order to reduce the number of spaces required and thus the total area of the

⁶Other threats can be attached to this strategy like the bound of building laws [8]

⁷This ability can be also used in urban design of housing, such as decreasing the parking area by suggesting different uses for it in certain times [6].

⁸Le Corbusier named used this strategy in his famous housing project “Unité d'Habitation” in Marseille- France 1947

housing unit. Another example is the multi-use of central spaces, courtyards and central halls, which provides a major space for both circulation and social activities [10]. Open plans can be also seen as an application for this strategy: a major space that fits a multiuse such as living, dining and kitchen in one open space. On the scale of the house, it is also possible to think the efficiency of using the unit by suggesting another use of the housing unit with its main use. For example the house or a part of it may be used for another function like office or small kindergarten during specific times of the day or in seasonal moments.

This strategy is highly recommended for affordable housing design. The ability of multi-use of the space can clearly reduce the needed area of the house and also the needed partitions for separating rooms, which helps to decrease the amount of building and finishing materials. However, this strategy may require a limitation of structural elements in order to merge uses in one space. The result is relatively larger spaces, which can suggest some weaknesses, in terms of construction methods. For example, the need for a large and open space creates large spans between structural elements, and so makes some restrictions on the construction methods. Furthermore, the multi-use of the housing unit may be seen as positive in terms of indirect effect on householder's income, but it has limited effects in terms of values of affordability of this paper, which are the decreasing housing area and amount of building materials. Besides, this strategy may suggest strict on spatial design to fit more than one function by the unit.

EXAMINING ADAPTABILITY STRATEGIES: USING SWOT ANALYSIS

We can conclude from the previous review that designing for adaptability has much more positive values than negative ones in terms of affordable housing design. This makes adaptability a useful approach for lowering housing costs design if the negative effects are understood and recovered. Table 1 aims to summarize the previous review of adaptability strategies in order to understand these positive and negative effects. Positive effects are described as strengths of the design that lead to the opportunity of successful affordable housing, while negative effects are described as weaknesses of the design that can lead to failure of affordability.

Table -1 Summary of strengths, opportunities, weaknesses, and threats of adaptability in terms of designing affordable housing

Advantages	Strengths	Ability of spaces and units for merge, division, growth, changing uses, and multiuse.
	Opportunities	Decreasing housing area and construction costs.
Shortcomings	Weaknesses	Strict on spatial design and implementing methods.
	Threats	Inefficient use of space and building materials.

In order to clarify the proposed approach for designing affordable housing based on adaptability, we will look deeper for all previous strategies of adaptability in order to analyze the advantages and disadvantages of each. Hence, these strategies will be examined in terms of suitability for affordable housing design. We will use SWOT analysis⁹ as a method for this examining. Hence, Table 2 highlights the strengths and opportunities offered by adaptability strategies at the scale of the internal space of the house, as well as the scale of the housing unit. In addition, the table highlights the weaknesses and threats that may occur by using such strategies on both scales as well. SWOT analysis for adaptability strategies refers to mentioned values of affordable housing design which are: reducing housing area, reducing the amount of materials used in construction and finishing, and the ease of implementation of the design. Such values will be discussed both on the short and the long terms.

According to Table 2, all previous strategies have strengths for designing affordable housing as all of them have opportunities, in different matters, to decrease the housing areas or/and amounts of building and construction materials. However, these strategies may vary according to the level of their strengths, as an example the ability of multiuse could be a stronger approach for designing affordable housing compared to the ability of merge, because it leads to more opportunities.

In addition to strengths and opportunities, table2 illustrates four classifications for adaptability strategies for controlling weaknesses and threats¹⁰ in terms of designing affordable housing which are:

1. Strengthening strategies that don't have weaknesses or threats such as the ability for multiuse of the space, which are encouraged to be used in the design as these will offer opportunities for strengths without risks.
2. Overcoming strategies that have only weaknesses and don't have threats. The ability of changing is an example, the use of the unit, which needs an overcoming strategy to control the restriction in spatial design. This can be solved by recommending suitable functions and discouraging another for the units in the first stages of designing process.
3. The third is mobilizing strategies that have only threats such as the ability of growing units, which needs to mobilize the strategy in order to ensure that there will be no inefficient use of space in housing in the short term by suggesting a temporary use of the selected area of extension.

⁹A SWOT analysis is an analytical method used in the evaluation of possible strategies in order to direct our choices in an efficient and safe way. It is used in many fields of planning that requires economic concerns. The SWOT model was first proposed by Ken Andrews in 1971. Such model aims at making balance between internal and external aspects of enterprises [16].

¹⁰[11] Proposed these four strategies to avoid weaknesses and threats based on SOWT analysis: overcoming, negative control, mobilization, and strengthening.

- The fourth is the negative control of strategies that have both weaknesses and threats such as the ability for division. This needs the control of weaknesses by the restriction on the implementation methods in order to avoid threats such as inefficient or expensive building materials. In this case, using this strategy requires choosing Low-Tec solutions for division to avoid such a threat.

Table -2 SWOT Analysis: Adaptability strategies for affordable housing design

Strength		Opportunities				Weaknesses				Threats				Control of Strategies
		Decreasing housing area		Decreasing construction costs		Strict on spatial design		Strict on implementing methods		Inefficient use of spaces		Inefficient use of building and finishing materials		
		Short -term	Long -term	Short term	Long term	Short term	Long term	short term	Long term	Short term	Long term	Short term	Long term	
Ability for Merge	Units													Overcoming
	Spaces													Negative control
Ability for Division	Units													Negative control
	Spaces													Negative control
Ability for Growth	Units													Mobilization
	Spaces													Negative control
Ability for Changing use	Units													Overcoming
	Spaces													Overcoming
Ability for Multiuse	Units													Overcoming
	Spaces													Strengthening

After analyzing the previous strategies of adaptability, their characteristics and preferable uses, we suppose that every strategy has its own potentials for affordable housing design on several scales. However, there are some strategies of adaptability that are clear of weaknesses or threats in terms of design for affordability such as ‘the multiuse of the space’. Other strategies can also be used but with special awareness about their weaknesses and threats such as ‘the ability of dividing the space’. This awareness can lead to creative solutions of spatial design and implementing methods that guarantee the success of these strategies in decreasing the costs of housing both in the short and long terms.

CONCLUSION

Adaptability is a high potential approach for designing affordable housing if designers make benefit of the advantages of adaptability strategies. Such advantages can be perceived in economic benefits through the adaptability of the space and the housing unit to the changing requirements of users. This ability increases the life of the building and thus the economic feasibility of housing becomes better. In addition, it reduces the required changes of spaces and buildings and this reduces, in its turn, future costs of demolition and reconstruction. Moreover, the ability of the building adaptability increases the chance to reduce the required spaces for residential units in the short and long terms.

However, it is important to take into consideration the shortcomings of adaptability strategies in certain cases such as the restrictions on building materials or the inefficient use of some spaces. For that reason, using unneeded strategies may reverse the adaptability approach against affordable design. Choosing inadequate strategies of adaptability for a project

may not decrease costs and thus some threats may emerge: such as using High-Tec tools for adaptability that requires expensive technologies of construction and building materials.

Accordingly, it is important to combine more than one strategy of adaptability to reach satisfying results of reducing costs, such as the ability of merging the housing units and the ability of multiuse of the space. This combination will increase the ability of design for reducing housing areas. Hence, it is important for the architect to determine what strategies of adaptability are suitable for his design referring to many items, such as social structure of users, site requirements, and availability of building technologies. This means that a successful design of affordable housing should consider selecting adequate strategies of adaptability for the specifics of the intended project.

Finally, describing a strategy cannot offer good results for affordable housing without a comprehensive study of housing form and building techniques. Thus, a critical study of every detail of the design is recommended in order to enable these strategies to increase properly the housing affordability. Accordingly, architects who aim to make affordable designs should avoid the expenses of complicated shapes and High-Tec building tools.

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