



THE COMPACT DESIGN AS A WAY TO INCREASE THE EFFICIENCY OF USING SMALL HOUSING UNITS. CASE STUDY: IRAQ

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Abstract

The current study provides a novel approach to analyzing the effect of compact design on housing unit space and functional utilization of space. The current design trend relates to the effective utilization of space by increasing the efficiency of multifunctional furniture.

The study takes two steps to increase the efficiency of using small spaces. First: The small units will develop into residential units with open spaces. That does not depend on their design on separating walls and the separation of spaces. Second: The study will present a solution to increase space use efficiency by presenting a compact design. It integrates all vital functions into a multifunctional product that meets all residential unit needs.

In order to compare a small dwelling unit with a conventional design to the suggested conceptual design and to further the study's goals of measuring performance efficiency of usage, a 3D design will be given as an alternative product. Created by the author

Keywords: Compact Design, Small Housing Units, Open Spaces, Iraq.

Introduction

It is important to discover the possibility of taking advantage of small spaces while submitting a study proposal that offers a compact, multifunctional design at a cheap cost that suits all segments of society. Previous studies did not provide a solution to provide an integrated interactive housing unit with a compact design. All design alternatives were limited to developing a single product to perform many functions. Moreover, a large part remained an obstacle to obtaining a multifunctional housing unit. The compact design will provide a single product operating with a flexible system to create an integrated housing unit installed in the smallest available space. The primary aim of the design is to promote interactive living. As a result of technological advancements, the utility of modern dwelling design has evolved in recent years. The design must be flexible to allow for future changes in the shape and function of the design to meet changing human expectations.

1 - Compact Design Concept

The compact design means the multifunctional design, which means creating the largest number of possible functions in one design. This design achieves a modular system in architecture and high flexibility in use. When the compact design is in a small space, it increases the efficiency of space use for a larger area by integrating more than one function. In this study, the integrated design's functions will be determined with a single product according to the activity concerned.

A - Flexibility: Flexibility is defined as a design theory without barriers in its physical impact on the structure[1]. The design can change the housing unit's internal configuration according to the variables[2]. Flexibility may allow changing the layout of the housing unit without damaging the basic structure of the building.

B - Modular System: The Architectural Encyclopedia defines a module as (the systematized approach to de-

sign). Any architectural product with standard dimensions is the design [3].

2 - Compact Design Applications

The use of small housing design methods is important in meeting housing needs. A review of compact designs will be presented through design examples of some organizations and companies that offer multifunctional compact furniture.

A - ORI: is a multifunctional furnishing solution that recognizes the negative space and plays an important role in creating livable long-housing while providing many amenities desired by the urban population.

ORI, [4] is a product of the furniture standard multifunctional consists of a bed and wardrobe and workspace and shelves and sofa, this product can be transformed from a bedroom to a living room is more spacious and home office by changing the configuration of each component of furniture components (Figure 2.1).



Figure 2.1: ORI product

B - Ikea sofas: Ikea [5] has produced designs that combine the sofa-bed compact and modern way. The flexible design of this sofa makes it transform into a bed as needed (Figure 2.2).



Figure 2.2: IKEA sofas

C -Gaysan Company Furniture, [6]The company is committed to providing the best solutions for saving space with the brand Multimo in global markets. Product group and quality are among the first five producers

worldwide. The company also realized some integrated housing projects with these walls, such as mobile murals, compact containers, student residences, hotels, studio apartments, and home offices (Figure 2.3).



Figure 2.3: Multifunctional Furniture, Multimo

3 - Some studies about small space solutions

The most important theories and studies have been put forward to address the problem of small spaces. These studies will reveal the possibility of optimal use of the compact design and its impact on space (according to the chronology) :

3.1 Previous literature

A - Thogersen Kristoffer, 2013 [7], A study was present to find smart solutions for small spaces and define the relationship between furniture and small residential units, and their relationship to the well-being of persons, taking into account the surrounding environment.

The study presents the final findings of the literature about the provision of multifunctional furniture. By definition, this type of furniture cannot be considered a dwelling unit component as much as a part of compact furniture.

B - Simona Canepa, 2017 [8], The study presents a concept about the possibility of the effect of flexibility to create a changing interior space according to daily activity through multifunctional furniture. The study presented four proposals, two related to flexibility and mobility, while the other presented a case study of a fixed, non-mobile living reality.

The study results reached a proposed design that works with the flexibility system by providing built-in furniture with many functions, such as the sofa, the bed, and the dining table, with a separate kitchen and a fixed bathroom in all the proposals.

C - Husein Ali Husein, 2020 [9], Presented a study on multifunctional furniture and its importance in increasing the efficiency of small spaces in Zanyari Towers apartments in Erbil/Iraq. The research paper aimed to maximize small spaces' use efficiency and comfort, providing solutions in using multifunctional furniture as an alternative to traditional furniture.

The possibility of forming furniture suitable for the residential apartment scheme will provide more free space. The proposed designs meant reducing the financial cost of furnishing and addressing the problems of permanent home maintenance, as it is compact and reduced furniture.

The study did not provide a clear picture of the nature of the alternative designs and the possibility of their functional solutions to solve the problem of the small space that constituted a crisis experienced by the residents.

3.2 Concluding Observations

Some studies of recent years have presented the possibilities of optimal use of furniture and flexible spaces, while others have presented multifunctional furniture applications and how to make optimal use of them in small spaces.

The studies did not provide the possibility of developing furniture as an integrated housing unit product. Thus, the solution to the problem of small spaces was limited to furnishing the space with some sofas that can be folded and transformed into sitting units or work tables.

4 - Research proposals

Alternative housing often requires an important design feature to be more functional and desirable. Creating a full compact design reduces the demand for space and standardizes use, reducing the number of interior walls. Previous studies presented many ideas and technical solutions to save compact space. A dining table and the kitchen opened to the living room. Furniture is folded or into the walls to save space in other designs.

The alternative design will provide a cubic product that opens into different parts. Each part produces functional tasks represented by the parts of the housing unit. Part for the kitchen and another for living and sleeping, while the design of the bathroom and the toilet on the back side of this part of the kitchen will save in the installation of water and plumbing. At the same time, this product will provide a solution to provide a single piece of furniture that results in an integrated housing unit.

The space of the housing unit will be desirable to be mobile and convertible, while it will also use other technologies such as functional furniture, folding walls, and an integrated hidden bathroom door. Omit requirements trends, the alternative design is comparable to all standard condominium schemes but simultaneously differs in space use and minimization to be compact and versatile (Figure4.1).

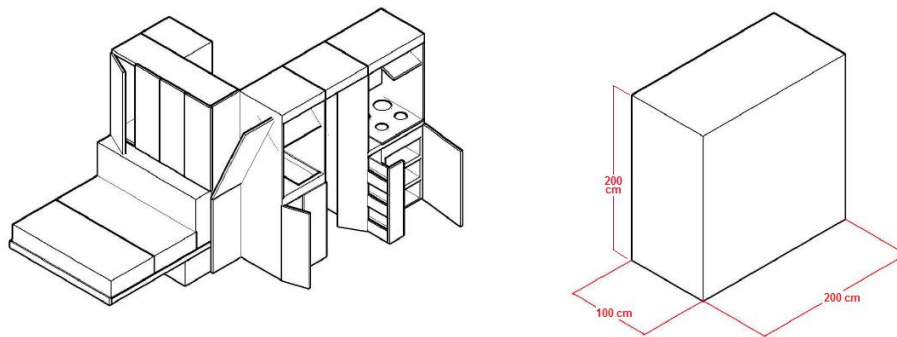


Figure 4.1: Alternative design (researcher design)

The alternative design is considered a launch for an integrated housing unit from one product, consisting of standard dimensions of 1-meter width, 2 meters length, and 2 meters height. This product contains an integrated kitchen, bathroom, and living room represented by the sofa and a flexible transforming table representing a dining table and an office table according to usage. There are lockers, a washing machine and a sleeping bed for two people.

4.2 Possible Transformation of Housing Units

The alternative design provides a product that allows the transformation of the interior space from a divided space to an open space without walls. This is done by integrating all the functions of the spaces in a compact space. It allows different dynamic activities to the interior space through flexible design applications and the

transformations resulting from the multifunctional design alternative. The comprehensive alternative design functions affect the shape of the housing unit and design it from a housing unit with multiple spaces to a housing unit with one space.(Figure4.2)

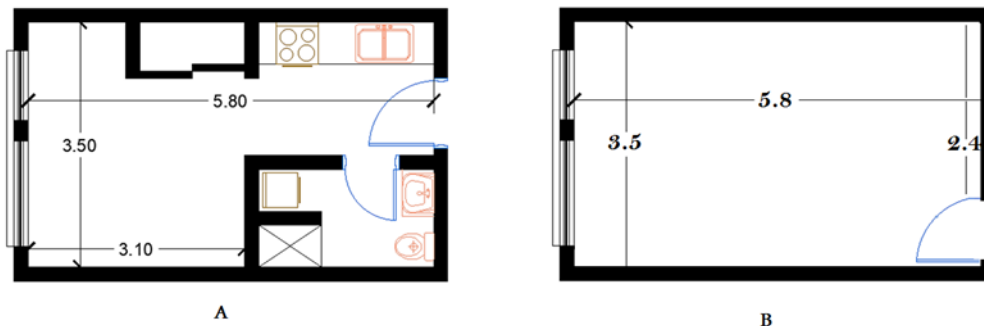


Figure 4.2: A.original design. B.alternative design

The alternative design's bathroom, kitchen, and living layout are like all the schemes in the previous studies, with modifications made, as the first was divided into 3 spaces. The alternative design offers an open space free from dividing walls.

4.3 Alternative Design Concept

The first part, defined by part 1, is divided into three sections (A, B, and C). A special function will represent each part. The second main part, defined as part 2, is also divided into two parts represented by (D, E). These two parts get their functions(Figure 4.3).

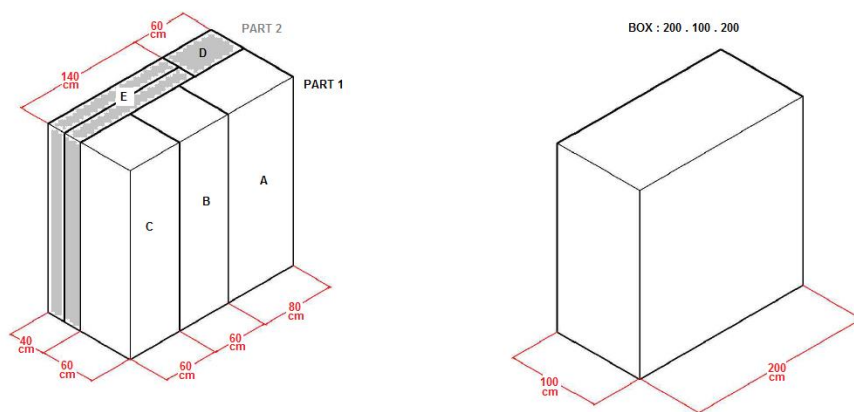


Figure 4.3: Analysis of The Initial Form of The Alternative Design

In the second part, represented by (part2), the part (D) splits to rotate around a fixed axis connected to the original (part2) with the part (E) to take a special shape for its function (Figure 4.4).

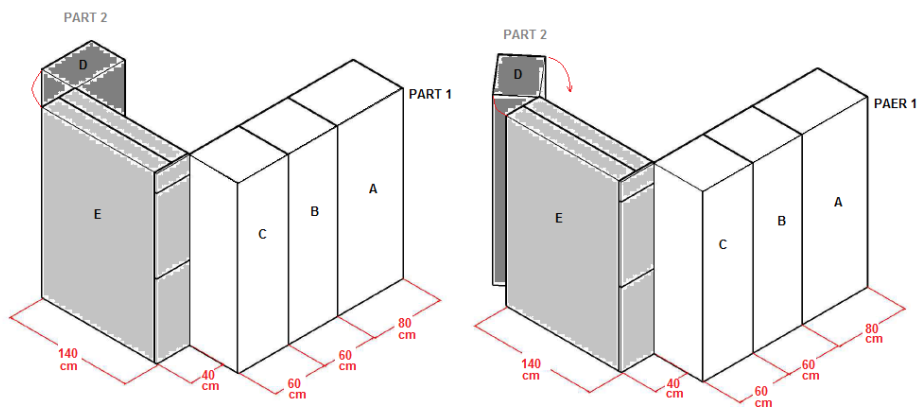


Figure 4.4: Part (D) Splits To Rotate

The main and secondary departments' functions were identified after dividing them into two main parts and 5 flexible secondary parts. (A,B,C,D,E)

Part1 represents the fixed part that forms three parts, where (A) is represented by a cross-sectional area of 60 cm for the cooker (A1) and a small refrigerator (A2) and upper shelves for storage, which is the standard space for these functions. (B) is represented by an entry door, and (C) is represented by a dishwashing basin (C1), a lower cabinet for dishes (C2), and upper stage shelves (Figure 4.5).

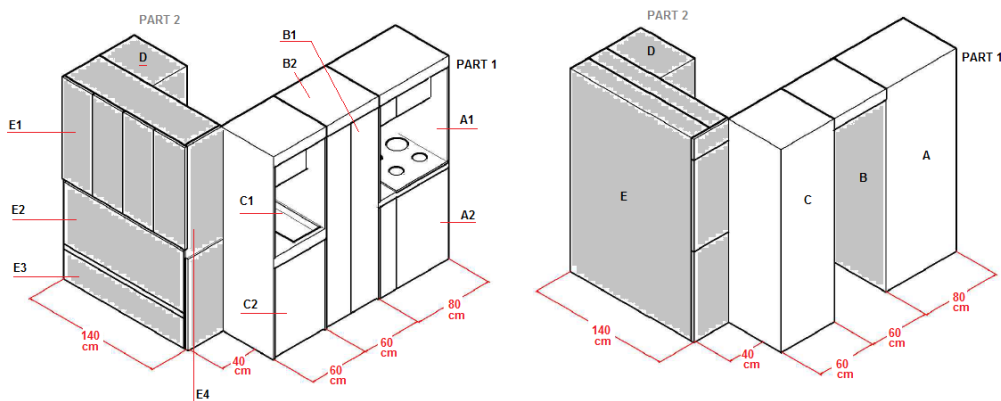


Figure 4.5: Definition Of Functionality For Each Part

Figure (4.6) shows in part1. (A2) kitchen special sliding storage compartment. (part2) explains how the lower part of the closet is transformed into a sofa to sit for two people in complete comfort, and then a sliding part that represents the structure on which the bed is base is drawn.

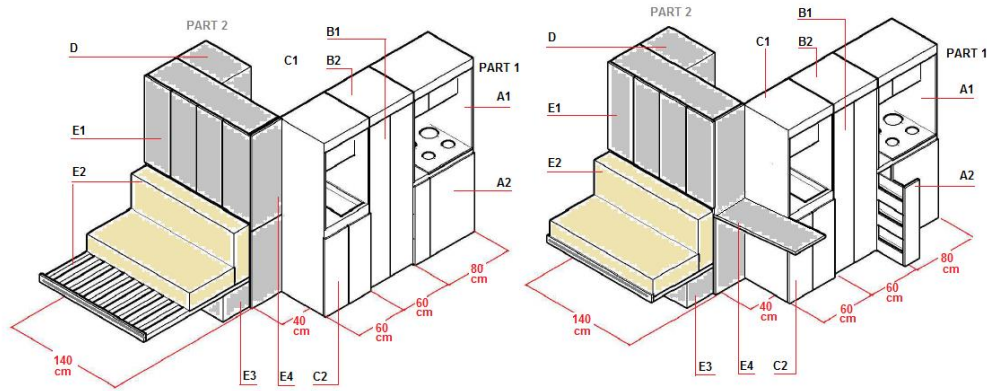


Figure 4.6: Sofa Bed

In (Figure 4.7) shows the back of the multifunctional product. The back of the (part1) has an (A3) flexible motion hidden shower head, and a transforming toilet to be hide in the wall of (part1- C3), which reflects the functions of many parts.

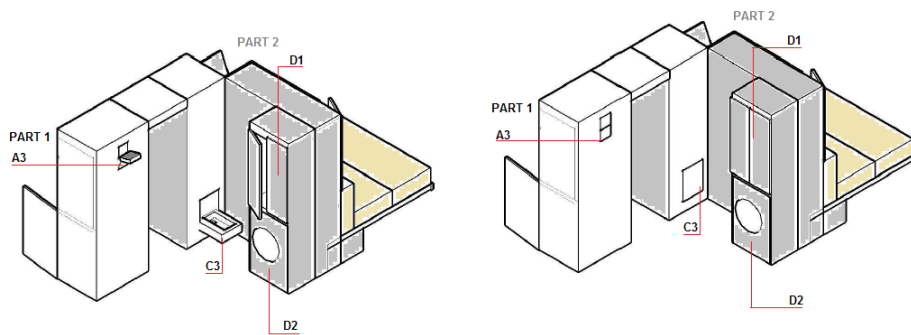


Figure 4.7: Bathroom

Free of dividing walls and open spaces (Figure 4.8). Thus, the compact design would be compatible with the case study's alternative housing unit plan design. Thus, the alternative design product can be adapt to the free space to form a multifunctional small housing unit.

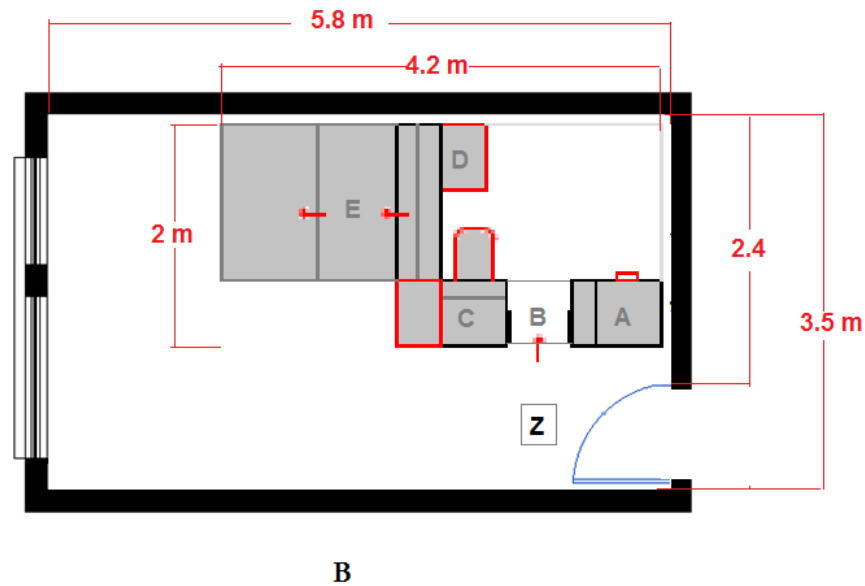


Figure 4.8: Alternative Design Multifunctional Residential Unit

5 - Results :

Compare the obtained results by evaluating the efficiency of using the original space and the proposed design alternative to reach the following results:

- A.**The alternative design is preferable to the original in terms of space efficiency.
- B.** Taking into account the overall weight of the building can also lower the size of the furniture and goods used within it, and reducing the size of internal units of buildings can also reduce the energy requirements for ther-moregulation and air circulation.
- C.** The use of industrial wood led to more flexibility in forming and manufacturing interior furniture in record time.
- D.** Reaching standard standards for the cost of housing, measured per square meter. An approximate cost was reached, equivalent to half the cost of traditional construction.

E. The possibility of using multifunctional furniture in more than one way. This enhanced functional design using simple techniques.

6 - Conclusions :

A. The importance of multifunctional design in transforming small spaces into more exploitable and valuable spaces.

B. Linking the architectural design, interior design, and planning of the internal movement of the space is the basis for the success of the planning process.

C. Space planning requires organizing between internal elements and systems such as walls and furniture, which vary to suit each space.

D. The importance of the design treatment of the interior space and the duplication of use, taking into account the needs of the user of the place.

E. Building and finishing materials have become an integral part of the design. It is necessary to have full furniture designs and how to use them.

F. Multifunctional furniture is more functional and valuable. It is the optimum solution for the use of space.

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