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Chapter 1

ADAPTIVE REUSE OF INDUSTRIAL BUILDINGS WITHIN THE FRAMEWORK OF SUSTAINABILITY AND THE CONCEPT OF "LOFT"

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1. INTRODUCTION

Buildings have different service lives that can vary according to their manufactural material. Nonetheless, this period of time may change depending on usage, maintenance-repair conditions, and preservation. Historic buildings are also among the most important cultural assets that should be preserved. Some buildings, although still standing without being damaged, are sometimes not able to sustain their old function. In such cases, adaptive reuse of these buildings is of great importance in terms of economic, social, and environmental sustainability. In this study, while addressing the points to take into consideration during adaptive reuse, the transformation of industrial buildings into "Loft" type residences in the USA, that reached the present day from the industrial revolution is also analyzed with examples.

2. CONCEPT OF PRESERVATION AND ADAPTIVE REUSE

2.1. Concept of Preservation

Cultural assets are divided into two as immovable and movable cultural assets. While the concept of preservation contains maintenance, conservation, repair, and restoration work for both; adaptive reuse is included in the concept of preservation for immovable cultural assets.

2.2. Concept of Adaptive Reuse

Adaptive reuse is the act of reutilization by making necessary arrangements for different functions in cases where the buildings are not physically expired but cannot fulfill their former functions.

Buildings harm the environment in the course of their construction time. Plus, if the lands on which the buildings are located are considered as natural resources, it is more of a logical decision to transform existing buildings with preservation, maintenance, repair, and restoration rather than demolishing the existing structures or building a new one in a new place.

3. THE BENEFITS OF PRESERVATION AND ADAPTIVE REUSE

The benefits of preservation and adaptive reuse can be listed as follows; prolonging the structure's life, preserving historical values and passing it down to the next generations, contributing to urban spaces, saving on the energy that would be spent to construct a new structure, and preventing the harm to the environment.

4. ONE OF THE FIRST EXAMPLES OF ADAPTIVE REUSE: GASOMETERS IN VIENNA

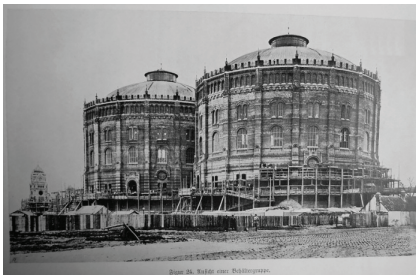


Figure 4.1: *Gasometers in Vienna, 1896 (URL 1)*

Figure 4.2: *Living Quarters in Vienna, 2001 (URL 1)*

The structures built as gasometers were shut down in 1984, as natural gas production replaced town gas over time. Projects have been proposed for the adaptive reuse of gasometers. Among the projects for each block, the projects submitted by Coop Himmelblau, Wilhelm Holzbaue, Manfred Wehdorn, and Jean Nouvel were selected. The four blocks were re-established as shopping area, work space, office and living space between 1999 - 2001.

5. REASONS REQUIRING ADAPTIVE REUSE

5.1. Historical – Cultural Reasons

As a result of the change over time, technology and economy, no longer needing the function that was once needed in the past,

Maintaining sustainability of the buildings that have historical values by preserving them.

5.2. Financial Reasons

Contributing to the economy as a result of the interest shown in history by preservation/restoration of old buildings and their reintegration into society,

The cost of adaptive reuse being lower than the cost of building new structures.

5.3. Environmental Reasons

In the case of a region being used for a certain purpose, changing the building functions accordingly (Such as, residential areas should not be situated in an area where waste sorting plants are established).

6. FACTORS AFFECTING THE SUITABLE FUNCTION SELECTION

6.1. Location

When deciding on the subject of adaptive reuse of a building, its location and surroundings should be researched, and the function needed in its location should be analyzed. Physical and geographical properties also play an important role in the function selection. For example, the industrial buildings in the city had a negative impact at the Golden Horn and its surroundings over time, due to the pollution they created.

It is possible to say for the factories around the Golden Horn experienced a locational change by being moved outside the city. While determining the appropriate function for the vacant industrial buildings, the re-use potential as a recreation area can be considered by evaluating the feature of its location being on the waterfront (Kaslı, 2009).

6.2. Functional Construct

Functional construct should be evaluated in relation to the location of the building. It would be more appropriate to consider the function of a bank for a structure worth preserving in the middle of a commercial area rather than a library function, in terms of the functional interaction of the buildings (Kaslı, 2009).

7. THE HISTORY AND THE FUTURE OF INDUSTRIAL BUILDINGS

Early industrial buildings were built as multistorey (maximum 7 floors), with natural stone or brick, masonry structure and wooden flooring, in accordance with the architectural solutions known until the end of the 18th century (Taner, 2011).

Due to the lack of advanced building materials and technology, the gap that could be passed was limited. Machines have replaced the manpower in production with industrial revolution. As machines working in conjunction with each other were developed, large open areas were needed. The development of cast iron from the middle of the 19th century enabled the establishment of horizontally expanding industrial complexes. Thus, multistorey industrial buildings have been replaced by undivided, long-span buildings.

8. REUSE OF INDUSTRIAL BUILDINGS

Historical buildings lose their functions over time, and as they are left empty and neglected, there is an attempt to keep them alive via renovation with a new function. These buildings are flexible enough to enable changes in their interior spaces due to their size, distinctive architectural features,

and robust structural qualities. Typically, these buildings have high walls, wide windows, and are bare on the exterior. Therefore, they are deemed very suitable for art venues during adaptive reuse. Moreover, they allow a flexible usage with their structural qualities, large and spacious interiors, high walls and wide windows. (Kariptas, F.S. &Aytis, S. &Kariptas, F., 2020)

With a change in function, sustainability of building worth protecting can be maintained throughout the history. These buildings worth preserving are historical and cultural part of society, and should be handled without losing their inherent structural features. Hence, the characteristic features of the building should be analyzed, its strengths and weaknesses should be identified, and the space should be handled after deciding which techniques to use.

If new building elements are to be added to the building in the process of adaptive reuse, they should be added using materials and techniques suitable with the texture of the existing building. In addition, in order to allow the structure to be reused with another function in the future, these newly added structural elements should be able to disassembled afterwards and should not cause damage on the structure when disassembled.

9. THE EFFECTS OF ADAPTIVE REUSE ON SUSTAINABILITY

The concept of Sustainable Development is described as "meeting the needs of today without compromising the ability of future generations to meet their own needs" (Bozlagan, 2005). In the Brundtland Commission where this idea first emerged, it was realized that there are different dimensions to development. These are divided into three as economic, environmental, and social dimensions. Although these three sustainable development dimensions have different focal points, they are complementary elements.

9.1. Economic Effects

The energy that would be spent in adaptive reuse of an already existing building is less than the energy that would be spent to construct a new building.

Usually, it can be said that repair and reuse costs of old buildings are between 50% to 80% lower than the costs of constructing new buildings (Kaslı, 2009).

9.2. Social Effects

Buildings carry many social, cultural, and economic information regarding the time and the society it as built in. Life-style, technical and architectural properties of that era are some of this information. Preservation

of the building and reintegration into society with new functions ensures that this information is passed down to future generations. Also, the lack of social reinforcement due to its location is also eliminated.

9.3. Environmental Effects

Efforts to increase the quality of the urban texture by preserving the historical structure and infrastructure can be a solution to energy consumption and pollution problems. Besides, environmental elements are destroyed during the process of construction a new building. This destruction would be averted with adaptive reuse of existing buildings.

10. ADAPTIVE REUSE IN UNITED STATES OF AMERICA: THE CONCEPT OF "LOFT"

As industrial buildings lost their functions over time, these buildings were tried to be reintegrated into the society with different functions in different countries and cities.Industrial buildings that enable many new functions with their wide and spacious plans have emerged in America with the "Loft" structure function. The concept of "Loft" which emerged in one of the oldest settlements in America, in the Manhattan area of New York City, has been used in the literal sense of upper floor and attic.

The closest meaning to today's utilization is in the Oxford English dictionary which is described as "The name given to large and usually open spaces on each floor of multistorey industrial buildings in the United States". Since the end of 20th century, the word "loft" has been used to describe large areas whose original structure was converted to residential use. (Taner, 2011).

In the 19th century, loft type structures emerged in Manhattan's Soho district, where industry-related production was seen the most in New York. Although they are used to describe large areas converted to residential use, they can have different functions. Despite prioritizing residential function, multifunctional usage is also possible. In fact, when loft type structures first emerged, they have become places where artists such as painters, dancers, and sculptors continue their work. They have been preferred by artists due to their proximity to the city center, wide space and low prices.

Between the years 1950-1970, "Lower Manhattan Plan" came to sight. According to this plan, the buildings that American banker and statesman David Rockefeller called "commercial slums" would be demolished and new apartments would be built in their place. Town planner Chester Rapkin examined the area in 1963 and stated in the "Rapkin Report" that establishing a new residential area in the SoHo district would consume approximately New York's one-year resource.

Lower Manhattan Plan was met with a set of social obstacles and reactions, so the implementation of this plan was abandoned. In a time where different opinions about Manhattan region arouse, these low-priced buildings that are close to the city center and have wide spaces were started to be used by artists as workshops. The buildings in this area offered the users the opportunity for various functions with their open plans.

Industrial production spaces, cast iron construction carcass reflecting the architectural characteristics of the era, provided the user many different functions with their wide glass facades, open plans and wide-open spaces. The change of the status of the artist as of 1960s, the rise of ecological thought and historical consciousness, were the factors that supported the emergence of the loft type residences in New York.

The architectural aesthetic criterion in the buildings that were built for industrial production and converted into lofts are as follows;

- Having a large area and height in terms of scale and ratio,
- Undivided, free plan (Figure 10.1),
- Bare structure (Exposing building and installations elements) (Figure 10.1),
- Wide windows, sunlight, artificial light (Figure 10.2),
- The texture and the colors used in materials,
- Harmony, coherence, uniqueness and personalized interior atmosphere (Kasap, 2014).

Having a large area in terms of scale and ratio, high ceiling;

The loft structure, which can be seen as multistorey or single-storey, have higher ceilings compared to today's residential architectures. Thanks to the high ceilings that allowed the creation of mezzanine floors, loft spaces could also be used as two-storey. In small buildings, the ceilings are supported by vaulted arches, and in large buildings they are supported by columns. Although most of them have the same square meters as American houses, their larger and more spacious appearance is related to their undivided or less divided structures.

Undivided, free plan;

There are no physical division elements in loft structures except for service units such as elevator, stairs, etc. (Kasap, 2014). Places with undivided spaces are perceived as more of a whole and thus appear bigger. Instead of using fixed elements like walls when dividing spaces, more dynamic elements are used such as curtains and furniture. Thereby, more personal and authentic living spaces surfaces.

In these loft structures, most of which have the same square meters as other American houses, the interior is usually cleared of all interior walls, and dining, sleeping, entertainment, and other routine functions are spread within this open space (Taner, 2011).

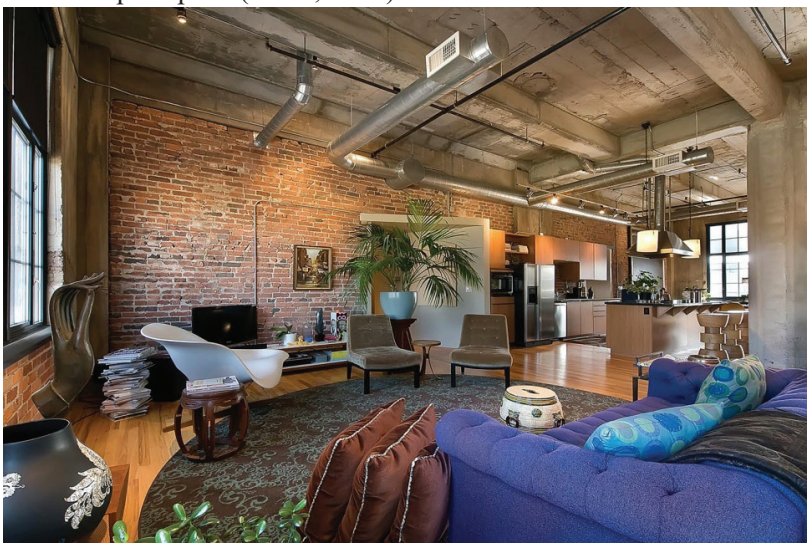


Figure 10.1: *Undivided Utilization of the Sitting Area and The Kitchen & Bare Structure, Denver, Colorado, USA (URL 2)*

Bare structure (Exposing building and installations elements);

Though it is not common in today's loft structures, exposed fixed structure elements can be found in the space as traces of the industrial past. When the industrial buildings designed for warehouses or factories were in the process of adaptive reuse, in the early examples, fixed structure elements such as ventilation, installation elements, and electrical cables were exposed instead of being disguised and sometimes painted over in order to give it prominence. This setup in loft type spaces where industrial traces are preserved and transformed, is not encountered in today's housing concept. For example, the preference for leaving industrial structure elements exposed in residential spaces may vary depending on the person. These elements can be impressive to some and disturbing to others.

Wide windows, sunlight, artificial light;

Since the industrial revolution, with the transition from manpower to machine power, industrial structures were built without any division and in a free plan so that these machines could be settled and operated in conjunction with each other.

In addition, factories had facade windows and skylights in order to benefit from daylight at maximum level due to long working hours. These

windows were both wide and tall in order to let the maximum amount of light in. Lofts also need different artificial light sources according to their types. In lofts, which structurally preserve the characteristic of industrial buildings, most commonly, illumination elements such as pendant lights and spots are installed on the gap of or over the beams and installation elements. The type of the artificial light varies according to the function of the space (Kasap, 2014).

Figure 10.2: *Using Natural and Artificial Lights Together, Denver, Colorado, USA (URL 2)*

The texture and the colors used in materials;

In architecture, the harmony between the texture and the colors of the materials is very essential. In loft structures using stone, wood or concrete on the floors; unplastered brick or stone on the walls; natural use of materials like copper, iron, steel on the windows and installation pipes are factors that create unity in spatial aesthetics. During the re-functioning of the industrial structures, the material and the texture with aesthetic value were preserved. Exposed concrete, red bricks, and rusted steel in loft type structures aesthetically have great importance. Although there is a difference in the colors of materials such as steel, wood, concrete, stone and brick, the colors have become close to each other with the aging effect.

Loft structures with prominent construction elements that have rough and uneven texture were transformed from old factories and warehouse buildings, and their essence was preserved and not much structural change was applied. Unlike mass housings that are very similar to each other and have standard spatial arrangement, loft type structures offer

customizable, flexible interior design opportunities, thanks to their undivided and open plan.

10.1. Prince Tower Building, New York

The building that was built in 1860, as The Ball, Block&Co. is located at the center of SoHo, New York. The building, which was 5-storey when it was first built (Figure 10.3), contained manufacturing and working areas in the top three floors. The first two floors, on the other hand, functioned as a store. In 1893, additions were made and it became to a 9-storey building. In 1979, it was re-functionalized as a residence, taking the name Prince Tower Building (Figure 10.4). Its facade made of marbles was in Palazzo style. It represents a true loft structure with its undivided interior, barrel vaulted brick ceiling and Corinthian columns.

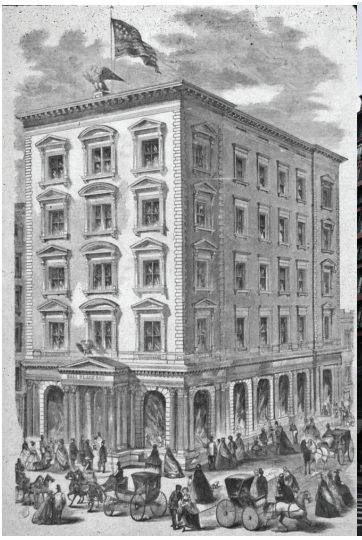


Figure 10.3: *The Ball, Block&Co. First Form when it was first built, New York, USA (URL 3)*

Figure 10.4: *Prince Tower Building, New York, USA (URL 3)*

Figure 10.5: *Undivided Interior, Prince Tower Building, New York, USA (URL 4)*

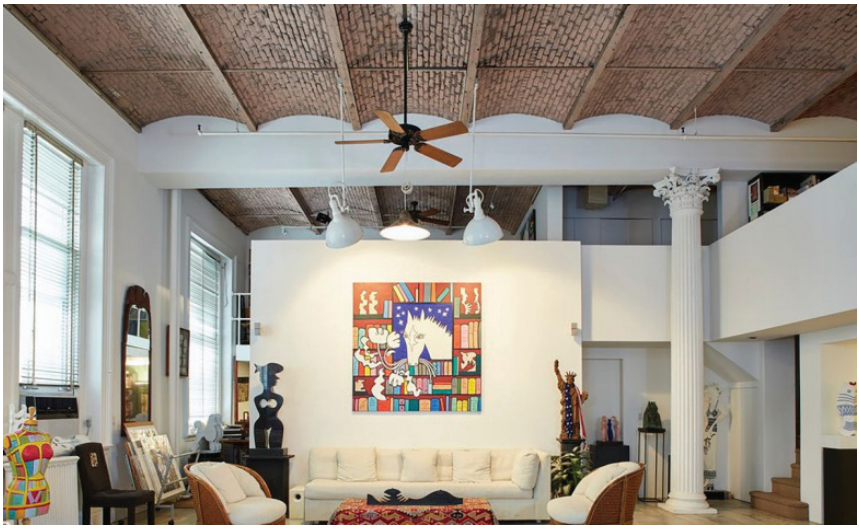


Figure 10.6: *Barrel Vaulted Brick Ceiling and Corinthian Columns, Prince Tower Building, New York, USA (URL 4)*

10.2. 583 Broadway, New York

It is a 12-storey building built in 1897 by Cleverdon&Putzel on 583 Broadway, Prince and Houston streets. In 1996, it was repurposed into a Museum of Modern Art from office structure. As the museum was moved to the Bowery, the building continued to be used as an apartment building. There are 19 flats in the building which is also one of the tallest buildings in SoHo.

Each floor in the Museum of Modern Art has a different façade application (Figure 10.7). Although the architects used traditional elements, they did

so with great skills and originality. For example, while there are three large arches on the ground floor, the southern entrance has a semicircular shape divided into two small arches and is covered by curved windows on both sides.

The belt above the sixth-floor features two large, embossed ornaments, while above the eighth floor, there are five winged creatures with open mouths.

The building has a wide and impressive cornice on each side, and there is also a lion's head at the top of the fourth floor, with the sides slightly indented.

The two-storied grooved Corinthian columns between the second and third floors are in stark contrast to the flat granite pilasters with leaf capitals on the ground. In addition, between the tenth and eleventh floors, there are two-storied high columns with doric caps.

On the fourth floor there are arched windows with elaborate eaves as repeated on the twelfth floor, while the arched windows on the eighth floor have grooved pilaster edges, and the tenth-floor windows are closed by baroque scalloped foreheads and surrounded by single-storey columns.

Figure 10.7: *Broadway Façade details, 583 Broadway, New York, USA (URL 5)*

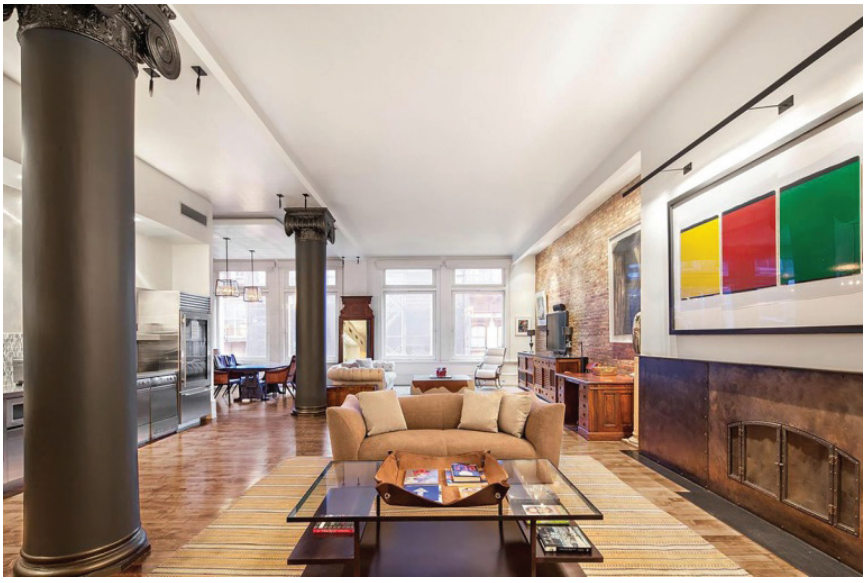


Figure 10.8: *Interior, 583 Broadway, New York, USA (URL 6)*

Figure 10.9: *Interior, 583 Broadway, New York, USA (URL 6)*

11. THE CONCEPT OF "LOFT" IN TURKEY

Loft structure type that emerged with the adaptive reuse of industrial buildings in USA, in 1950s, could not developed in Turkey, because Ottoman Empire was behind industrialization. Ottoman Empire industry adhered to traditional production methods and continued production by hand or simple small tools. Therefore, big scale industrial buildings were not needed.

As of 1840, modernization became mandatory for the empire, and besides the traditional methods for production, factories established by the state, individuals, and institutions were began to be used. In 1950s, most of the factories were established in Istanbul, due to its proximity to important transportation networks. Within this period, the Golden Horn became an important location in Istanbul, with buildings that had a potential to be transformed into a loft. However, in the 1980s, the project aimed at cleaning the Golden Horn was put into effect by the Istanbul Metropolitan Municipality, and almost all of the old industrial buildings in the region, that were already a handful, were demolished. This approach clearly shows why a real loft does not exist in large numbers in Istanbul.

Now, the loft has been stripped of its historical identity created by the combination of necessities, and has become an architectural concept and type that can be copied and modeled. Loft, which emerged as an economic and socio-political alternative to a traditional house form in the 1950s, has now become a desired and demanded commercial product in the 2000s. This product is a commodity that is in international demand today (Baba, E.C., 2016).

11.1. A True Loft Example: Büyükyalı Loft

Büyükyalı loft emerged with the conversion of a part of the cartridge factory into living spaces, built in 1881, located on the Kazlıçeşme coast. It is one of the rare buildings in Turkey that can be shown as a true loft. Its restoration by Metex Design took three years. It consists of basement, ground floor, and mezzanine. Stonemasons were brought from Bodrum, during the restoration phase, in order to preserve the existing natural stone structure. The existing material was preserved as much as possible, and the wood used in the carrier system on the roof was cleaned and repaired. The height of ceiling changes between 6.90 meters and 7.40 meters. After the restoration phase, smart home systems, floor heating, and cooling systems were added to the building.

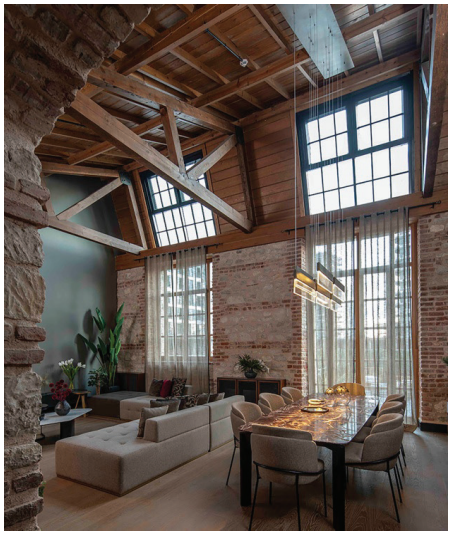


Figure 11.1: *Büyükyalı Loft Interior (URL 10)*

Figure 11.2: *Büyükyalı Loft Interior (URL 10)*

11.2.Levent Loft, Istanbul

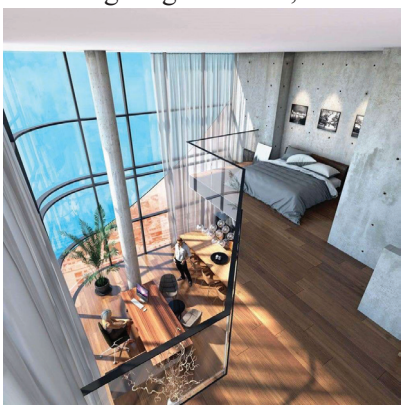
The Levent Loft project, designed by Tabanlıoğlu Architecture, and located on the Maslak-Levent axis, started its construction in 2006 to function as offices. While the production process was underway, the function was changed and it was redesigned as residence. Project was completed in 2007, and brought into service.

Figure 11.3: *Middle Floor Created by Dividing the Floor Height, Levent Loft, Istanbul (URL 8)*

Figure 11.4: *High Ceiling and Wide Windows, Levent Loft, Istanbul (URL 8)*

11.3.Loft Up / 7.60, Istanbul

The Loft Up / 7.60 project, located in Umraniye, was completed in 2017. The building, which has a mixed function as office and residence, has a ceiling height of 7.60, as can be understood from its name.



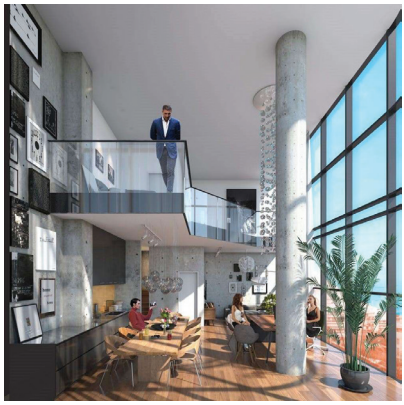


Figure 11.5: *Loft Up / 7.60, Istanbul (URL 9)*

Figure 11.6: *Loft Up / 7.60, Istanbul (URL 9)*

12. CONCLUSION

Industrial buildings, that was built for the functions of factory, warehouse or similar functions lost their functions over time. These now-functionless structures have revealed two opposing views in society; destruction and adaptive reuse. According to researches, it was determined that preservation and adaptive reuse provide many economic, social, historical, cultural, and environmental benefits in the context of sustainability. On the other hand, the demolishing the now-functionless buildings, and rebuilding them with new functions will not only harm the environment, but also will cost much more. There are some critical points in adaptive reuse of industrial buildings. there may be a need for new additions according to the new function. The material and technique to be used in such cases must be suitable for the material, technique, and texture of the existing building. In the future, it should be considered that there can be a necessity to bring another new function to the structure due to the changing conditions, and in cases where the parts added afterwards need to be removed, permanent damage should not occur in the structure.

Industrial buildings usually enable many new functions thanks to their undivided and spacious spaces. These buildings can be transformed into various spaces such as offices, residences, workshops or exhibition areas, and can be functionalized according to the needs of their location. The examples of this spatial transformation are frequently encountered in

different regions as it is in Europe, America, and Turkey. As for the scope of this study, the loft type structures that have emerged as an example of this spatial transformation in America are emphasized. Because Manhattan, one of the administrative regions of New York, is a region where industrial production is concentrated, examples have been given over this region.

In the first example of The Prince Tower, which was built in 1860, it is seen that number of floors was increased during adaptive reuse. One of the reasons for this can be the dense population in the Manhattan region, while the other reason can be the status indicator. It is taught that the higher the number of floors and the higher the occupied position in a building, the higher the status. Therefore, the buildings are detached from the ground as much as possible and both more space and increase in status is provided. For this reason, as you move upper floors,the rental prices move up accordingly. Despite the increased number of floors, the façade was preserved in The Prince Tower, and its continuity was maintained on the floors added in the same style. So much so that, when looking at the façade, it is difficult to notice the floors added later. Another example that was addressed was the loft type building called 583 Broadway, which was built in 1897. This building is the tallest building made in that region. This height can be attributed to factors such as gaining more space, and having a higher status, as in The Prince Tower. The SoHo region in Manhattan is the region where loft type structures emerged and are the most frequent. The reason for that is because settlements in these regions have a much older history and bore witness to the industrial era. Getting around in this area with a personal vehicle is a big problem for employees, due to the narrow streets. Therefore, employees in this area may prefer to stay in these buildings, mostly temporarily, as they are closer to their workplace. Loft- type structures in SoHo region, where they emerged according to needs, was not prevailed in Turkey, as Ottoman Empire fell behind in industrialization. As a consequence, it is rare to see real loft structures from the industrial revolution in our country. However, today it is used as a marketing tool, for commercial purposes. Adding a mezzanine to increase the used space, thanks to the height of the loft type structures, is used as a selling strategy in modern housing designs today. Although the only common feature of modern houses with loft type structures is having a mezzanine, today these houses are also called “Loft” for marketing purposes.

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Chapter 2

AN OVERVIEW OF THE CRITERIA AFFECTING THE DESIGN OF HOUSING FURNITURE

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1.Introduction

The term “furniture” comes from the Latin word “mobili.” Furniture is the generic term used to describe movable furnishings that are used to furnish spaces to sit, eat, work, and sleep.” (URL-1). In other words, furniture is portable or fixed equipment that offers convenience, comfort, and functionality in the needs of people such as sitting, lying, working, or eating to support their everyday lives. It is built to be practical, aesthetically, and ergonomically.

Under the structural elements of interior architecture, furniture is a spatial feature. One of the main responsibilities of an interior designer is to design furniture. Furniture creates a functional link amongst the furniture, the architectural space, and the space’s owner. Based on shape and size, it makes a sense of unity between the consumer and the environment. It keeps these spaces livable by adding comfort and convenience to room activities. Furniture adds to the aesthetic character of the interiors in addition to serving those functions. Its form, line, color, texture, material, scale, feature, relationship with other furniture and reinforcement components, and spatial organization play a vital role in defining a space’s design identity.

The furniture pieces may have linear, planar, or volumetric forms and straight or curvilinear, angled, or free-form shapes. It can be light, large, or heavy, and it can have horizontal or vertical ratios. Furniture surfaces can be designed to create a full and empty effect. Their texture can be slippery, smooth and shiny, warm and soft, or heavy and rough. Their colors can be natural or transparent, warm or cool, light or dark. Furniture has different formal features, forms, constructions, ornamentation techniques, fabrication techniques, and other features depending on the design style. Throughout history, technology has influenced the creation of furniture.

In light of these explanations, the furniture can be described as follows:

Furniture is a type of design object that facilitates life behavior by its size and shape while also providing beauty to people through physical characteristics such as texture, color, and form (Postel, 2012).

Housing is a human-made environment that allows people to protect themselves from environmental hazards and adapt to their surroundings. In history, humankind used caves and tree cavities to protect themselves from the harsh conditions of nature, but as living conditions changed, they began to construct their own houses (Üst, 2015).

Housing refers to the set of spaces in which a household, the smallest unit of society, carries out its daily activities. Residential architecture has evolved by designing a wide range of houses in harmony with the features

of the geographical area as well as the society's traditions, practices, and customs to satisfy people's shelter needs (Carsten & Hugh- Jones, 1995). Consequently, the house building in which they shelter and fulfill their basic needs predates the existence of ancient cities.

A person's activities to sustain his/her life in the house are divided down into nine categories (Gür, 2000). These are,

1- Restful activities include sleeping, resting, and sitting.

2- Nutritional activities include storing food and drink, preparing and serving food, and eating.

3- Hygiene activities include toilet actions, washing, personal hygiene, make-up, gymnastics.

4- Dressing and dressing activities include dressing, undressing, caring, repairing, stitching, and clothing storage.

5- Cleaning and repair activities include cleaning the house and possessions, washing dishes, laundry, and ironing.

6- Cultural and educational practices include reading, writing, researching, listening to the radio, and watching television.

7- Hobbies such as listening to music, playing an instrument, playing games, dancing, growing flowers, and feeding animals are examples of entertainment activities.

8- Interaction behavior with the outside World includes communication, welcoming visitors, issuing invites, transporting food and supplies home.

9- Other activities include child care, worship, sexual acts, and so on.

There are tools and equipment that supplement the shortcomings of the users for the activities mentioned above to achieve the desired results. These materials, which we call intervention aids, include a wide range of items such as tools, equipment, networking devices, cars, and, of course, furniture. For example, while sitting and sleeping furniture are used to perform relaxing activities in the house, cabinets for dressing acts, tables and seating components for eating actions, and tables and bookshelves for cultural and educational activities have all become necessities today's housing design.

This section of the book aims to explain in general terms the factors that influence the design of furniture used to carry out critical acts in residential interiors.

2.Furniture Design

As previously said, furniture is a design product. Humans must first have physical and mental comfort to continue their everyday life, particularly in

residential spaces. “Ease, make it simpler” is what comfort entails. Since furniture is a design product, it is important to clarify the term “furniture design” in this situation.

Furniture design shapes materials to incorporate the human body and construct a structure that fulfills the functions that a human being requires in everyday life. Furniture design shapes carry and form a framework using materials and construction methods based on the structure’s role, purpose, and design style. All furniture design features should view in terms of aesthetics, including function, purpose, design style, form, scale, proportion, structure, material, and construction process (Karasova, 2013). As a result, one of the essential factors that add features to a furniture design is aesthetics, which plays a role in establishing the moral atmosphere that people define the design style need in the room.

3.Housing and Furniture

People constructed shelters and manufactured furniture and other accessories to allow them to carry out daily activities. When the stones inside Lascaux Cave, one of the earliest known shelters, were investigated, they were carved and made into sitting platforms (Saiz-Jimenez, 2014). Stone shelves can be seen in the Skara Brae settlement’s houses in Scotland. The Catalhöyük settlement houses are also known for the sitting couches under which they buried their dead during the Neolithic period (Demirarslan & Demirarslan, 2020) (Figure-1).

Ancient Egyptian Civilization had furniture types shaped and diversified according to the status of the people in society among the housing styles that ranged according to the community’s role. The pharaoh, a priest, a nobleman, or a slave all had separate housing and furniture (Demirarslan, 2011).

Figure 1. Lascaux Cave Interior and Stone Platforms (URL-2); Stone Shelves in Skara Brae (URL-3) and Sitting Couches of Catalhöyük House.

The interiors of the Greek and Roman Civilizations houses were specifically designed for the use of men and women. Hence, the furniture provided distinctions according to purpose and gender. Men and women's use of space in houses was often characterized by furniture like "Kline"[1] and "Klismos" in Greek Houses. The number and order of the kline determined the form of the "Andron" banquet rooms (Figure-2).

1 A couch was a Furniture used in Greece as early as the late seventh century B.C.E. It was rectangular and carried by four legs, two of which could be higher than the other, allowing for an armrest or headboard to be supported.

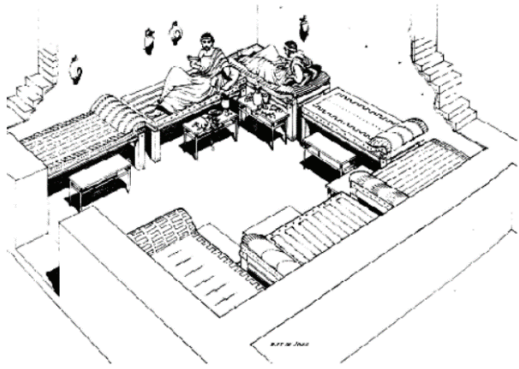

Figure 2. Andron and Klines (URL-4).

The Middle Ages were an era characterized by warfare, chaos, and economic hardship. The function and purpose of using furniture in the house were essential features over a 1000-year age. Religious symbols in Gothic style tended to shape furniture under the influence of religion: Casapanca, sleeper tables, credence, canopy bed, and so on (Boyla, 2012) (Figure- 3).

Human dimensions and requirements influence the creation of Renaissance houses and the design of residential furniture. About the fact that there is no definition of set furniture in residential furniture, the amount and variety of furniture available also increased (Boyla, 2012) (Figure- 3).

Although the furniture in Baroque and Rococo era houses was not as extravagant as that found in a Versailles Palace, it did include seating furniture, bedside tables, armuar, and credence.

In the houses designed according to the nineteenth century architectural styles such as Neoclassicism, furniture designed inspired by Ancient Egyptian, Greek, Roman, Ottoman, and Far Eastern life and furniture and new furniture types draw attention as the trend of the period. For example; the footrest poufs, cushions, and ottomans were inspired by the life of the Ottoman society and entered the residential interior (Figure- 4).

Figure 3. A Medieval Interior with Table and Credensa (URL-5); A Renaissance Interior and Furniture in Dvazzi Palace (URL-6).

Figure 4. Famous Traveler Pierre Loti in His House and Turkish Salon (URL-7).

The twentieth century was a period when the function was key to residential interior and furniture design. Many forces influenced the house, including wars, economic disasters, environmental issues, technological advancements, urbanization and population growth, and consumption frenzy. Similarly, the style of furniture has evolved in lockstep with the design of houses.

4. Developments in Furniture Design

As mentioned above, furniture has developed in parallel with the social, socio-economic, and socio-cultural conditions of the period to which it belongs. This development is strongly influenced by lifestyle, history, technology, building technique, and material properties in furniture manufacturing. At any time, innovations and changes in lifestyle, new materials, and rapid and low-cost production possibilities have influenced furniture design.

Furniture making, which was shaped by hand and continued as a special production until the nineteenth century, started with the development of steam technology in the nineteenth century. Thanks to the mechanization of production, machine production turned into furniture production. Machine production became a production type due to the automation of production. It was possible to mass-produce, move the same type and function furniture to wide segments of society with Biedermeier style[2] furniture, in addition

2 Biedermeier is an art movement that flourished between the end of the 18th century and the beginning of the 19th century, and evolved in line with bourgeois taste and interpretation of art, furniture, and painting, serving as the most prominent examples.

to the wooden furniture shaped by Micheal Thonet[3], by bending it with steam (Thonet, 1953)(Figure- 5).

Figure 5. Michael Thonet-Designed Chair No. 14 (7 Chairs That Changed the World, 2016); Biedermeier Furniture Samples from Russia 1820-30 (URL-8).

With the development of mechanization technologies in the nineteenth and twentieth centuries, the importance of costly ornaments and materials in furniture design declined, and difficult-to-manufacture details became discarded. On the other hand, as the principles of flexibility and modularity in design and usage have evolved, global use of furniture with the feature of being economic in use and production has arisen (Figure-6). For example; While Biedermeier furniture offered similar furniture for palaces to middle-class people, Thonet's chair was used in all interior spaces from America to Australia (Figure-5).

Figure 6. The Kitchen in 1920s Frankfurt, Germany, Was the First Modular Furniture Design, Designed by Margarete Schütte-Lihotzky (URL-9, 2016).

3 Michael Thonet (1796 - 1871) was a German-Austrian furniture maker.

Before the twentieth century, the richness and fine artistry in the ornaments served as a sign of quality, hierarchy, and prestige in furniture, whereas the idea of decoration in furniture began to disappear in the twentieth century. The color and texture of the material revealed characteristics such as construction quality and hierarchy of usage, rather than the ornament. Excess has been removed from the furniture, and it has been simplified.

The designer's role in furniture design has changed in the twenty-first century, as a result of advancements in furniture design and technology. First of all, the responsibilities of the designer have increased. The designer no longer only thinks about the ergonomics, texture, and materials of furniture, but also needs to direct his design by considering how it will be produced in a factory or workshop environment, how it will be packaged and shipped, the situation in the use and post-use process, disposal and recycling. The designer, who began working in a mass-production environment, has assumed responsibility for occupational health and safety topics. Furniture design is divided into specialties.

5.Factors Affecting The Design of Furniture Used in Houses

Many factors influence furniture design, and these factors differ and vary depending on periods. These elements are briefly described in this section as technology and material, lifestyle and culture, user need and function, gender, religion and philosophy, ergonomics, proportion and scale, design philosophy/concept, aesthetics, design element and principles, hierarchy, status, identity and economics. Of course, several other factors influence furniture design. The most important factors that influence the design of furniture used in houses are discussed in this section.

5.1.Technology and Materials:

Some factors are effective in designing or shaping furniture. Although these components differ according to periods, it is correct to say that technology is the most fundamental element. For example, Ancient Egyptian furniture had achieved a high degree of sophistication thanks to technological advances such as advanced carpentry tools in the Ancient Egyptian Civilization, especially the flawless use of lathe work in furniture with the invention of the lathe, and the ability to bend wood in steam and process materials like ivory (Figure-7). The Ancient Age furniture was created thanks to the Phrygians' mastery of wooden interlocking techniques (Demirarslan, 2011) (Figure-7).

Figure 7. Furniture in Ancient Egyptian House (URL-10).

Wooden inserts and frame construction furniture come to mind when thinking about medieval furniture. The Renaissance is the period when upholstery and furniture come together (Figure-3). Baroque, Rococo and Neoclassical periods are the periods when intarsia, carving technology was developed and used in furniture. Residential furniture diversified during the Georgian Period, also known as the "Four Elders Period"(Thomas Chippendale, George Hepplewhite, Robert Adam, and Thomas Sheraton) of furniture (Boyla, 2012). Furniture output images have been printed in the form of catalogs, and their production has spread widely (Figure- 8). In the nineteenth century, a new era was opened with the technology of bending the wood developed by the Ancient Egyptians and shaping it with steam, as stated before. The use of artificial wood, aluminum, glass, and plastic-based composite materials[4] in the industrialized furniture sector underwent a formal transition in the twentieth century. Smart innovations have started to influence and direct furniture design in the twenty-first century.

4 A composite material is a material that is made from two or more component materials with significantly different physical or chemical properties and when combined produces a material that has different properties than before.

Figure 8. Sheraton Furniture Catalog (URL-11) and Hepplewhite Furniture Catalog (Eberlein & McClure, 1914).

The material is certainly another element that influences furniture design. Solid wood was mostly used as a construction material in furniture production until the twentieth century. Particleboard (chipboard), medium-density fiberboard (MDF), plywood, and chipboard have been widely used since the advent of artificial wood material technologies in the twentieth century. Scandinavian furniture has risen in popularity, especially in terms of the use of wood. When Alvar Aalto's name is mentioned, images of flexible and elegant plywood furniture come to mind (Pallasmaa, 1985) (Figure-9).

Figure 9. Alvar Aalto's House, Helsinki (URL-12).

It is fair to say that the twentieth century saw a transition in furniture design thanks to the use of metal materials. With Bauhaus and Modernism, the use of metal materials, which began with aluminum in the Art Deco style, provided the best examples. Architects created furniture as part of the "Comprehensive Artwork / Gesamtkuntswerk"[5] concept (Figure-9). Aluminum and steel have had an important place in furniture construction. Although it started after the Second World War, the use of plastic-based materials, which gained momentum from the 1960 and '70s, shaped the furniture design. The "The Tulip Chair" designed by Eero Saarinen in 1955 using plastic, a material that allows mass production, is an important example (Roman, 2013) (Figure-10).

Figure 10. The Tulip Chair and Interior (URL-13).

5.2.Lifestyle and Culture:

Furniture characteristics such as form, use, and construction are influenced by lifestyle and culture. For example, in the traditional Turkish house, fixed reinforcement elements formed along with the building were used as furniture. The interior was designed around the principle of "less is better / One bite, one cardigan," which was the Turks' nomadic life philosophy (Figure- 11) (Demirarslan & Demirarslan, 2020), (Demirarslan, 2017). On the other hand, consumption and globalization, which started right after the Second World War and spread rapidly worldwide, changed the way of life and the living culture of societies. Almost all over the world, it has revealed similar daily life needs and styles, and the furniture used in

5 Some architectural authors have introduced the name Gesamtkunstwerk to describe situations in which an architect is responsible for the overall design and/or supervision of a building: shell, accessories, furniture, and landscape, detail, and so on.

interiors has become similar. Today's furniture defined as "Western-style" has become widespread. Especially after the Second World War, with the spread of a consumption culture defined as the "American Dream" to the whole world through advertisements and media outlets, large sofas, television units, modern kitchen equipment, and many more furniture has been accepted as the qualities of a developed society (Figure-12). Television programs, TV series, the internet, and social media have shaped people's furniture perceptions, influencing furniture choices and furniture design in terms of quality and need. People tend to put furniture in their houses that they see on TV or the internet.

Figure 11. Reinforcement Elements Shaped Together with the Building in Traditional Turkish Houses: Cedar, Wardrobe and Niches (Demirarslan, 2011).

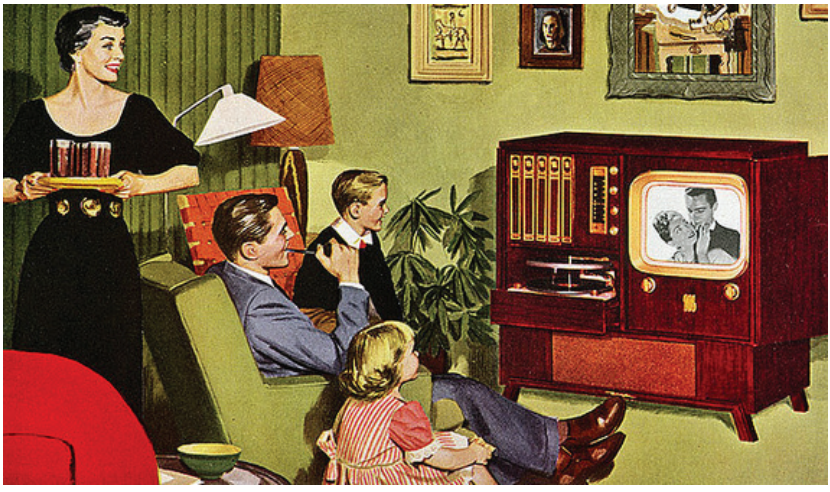

Figure 12. The "American Dream" Homes and Consumption Furniture (URL-14, 2014).

5.3.User Needs and Function:

Another factor is need. As in the design of the space, the necessity determines the function and/or functions in furniture design. For example; multifunctionality in furniture is an important factor in living daily life in narrow and restricted spaces in urbanized societies with rapidly increasing populations. For example; multifunctionality such as sofas with beds, coffee tables with tables, beds in cupboards have also affected the design of furniture by bringing the issues of modularity and flexibility in use to the agenda, and the use of furniture for different purposes has also provided economical use in flexible use.

5.4.Gender:

Gender plays an important role in furniture design in cultures shaped by factors such as living culture and religion. Women dealt with sewing at home in Ancient Greek and Aegean Civilizations, for example. “Klismos” chair, which contained feminine lines for women to sit while weaving in the section of their homes, forcing the boundaries with the fine size and combination details of its wooden cross-section with its fine workmanship, and attracting attention with its ergonomic structure compatible with the female body, was accepted as an expression of the place of lifestyle and gender discrimination in society (Smardzweski, 2015) (Figure-13). Homer described this chair as “looking like a Goddess.” (Demirarslan, 2011). In the same culture, the “Thronos” chair, designed specifically for men, was huge, ornate, enormous, and majestic.

Figure 13. “Klismos” in Ancient Greek and Aegean Civilizations (URL-15).

5.5.Religion and Philosophy:

Religion is another factor that effects furniture design. For example, religious elements or forms similar to religious building elements were successful in shaping furniture during the Gothic era (Figure-14): Rose window, clover motifs, pointed shapes, triangles and so on. Again, less and

simple furniture in the room have been successful due to the Zen concept of minimal life in the traditional Japanese home. As previously mentioned, the idea of the temporality of life from nomadic life seems to be influenced by the ideology of "less is better / One bite, one cardigan" in space in the traditional Turkish house.

Figure 14. Gothic Art and a Baby Cradle, Schnütgen Museum (URL-16), Similarities from the Decoration Details from the Palace of the Dukes of Venice.

5.6.Ergonomics:

Ergonomics is a critical element that forms furniture and ensures human harmony. People have known since ancient times that human measurements should be taken into consideration when making furniture. However, there are cases of ergonomics that were perfected in some times but neglected in others. For example; while the chair mentioned above "Klismos" was designed in the 5th century BC by considering women's ergonomics (Figure-13), seating furniture that was not suitable for human adaptation is also known as made in the Middle Ages. Although the stools were designed ergonomically with seating surface and height in Ancient Egypt, ergonomics is taken as a secondary design requirement in postmodern furniture with the understanding that "function follows form." (Morley, 1999) (Figure- 15).

Figure 15. An Ergonomically Designed Stool in Ancient Egypt, BC. 1400- 1350, British Museum (URL-17); and a Postmodern Armchair Designed by Peter Shire, (Morby, 2016).

5.7.Philosophy of Design / Concept:

Every design has an inception point. Likewise, the design philosophy (concept) is an important factor in the emergence of furniture as a design product. The inception point of design may occur within the context of a particular design style or occur independently of the style. The starting point and main idea of the design can sometimes be an image; it can be in the form of a material, sometimes an application technology, or an idea (Demirarslan & Demirarslan, 2020). For example, Marcel Brauer was influenced by bicycle handlebars while designing the "Wassily Chair," and tried to build a smooth solid metal pipe construction using metal material technology. Another example is Giorgio Caporaso's "X2 Chair," a furniture style made from various environmentally sustainable materials and manufacturing methods that can be used both indoors and outdoors (Figure- 16).

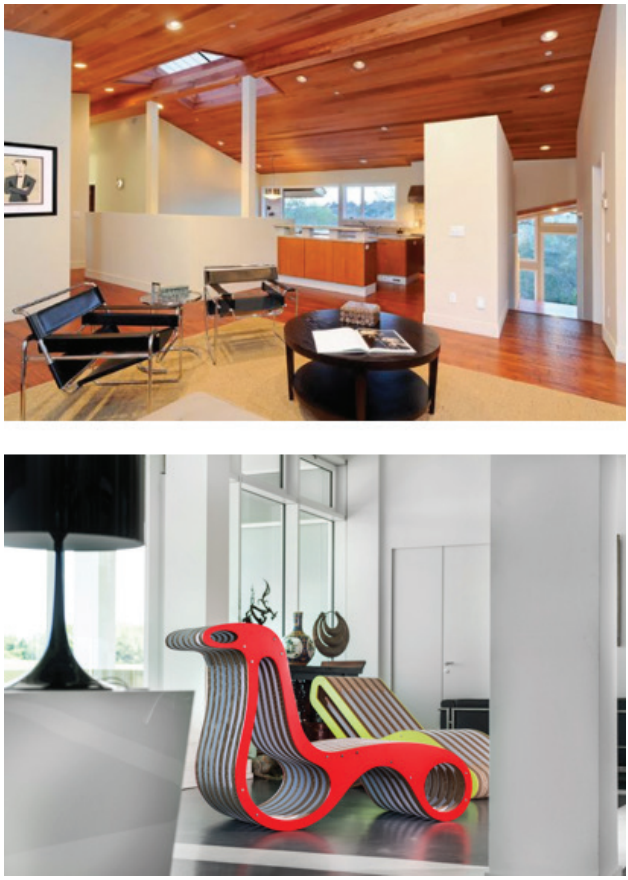

Figure 16. "Wassily Chair" (URL-18) and "X2 Chair" (URl-19).

5.8.Ratio and Scale:

Apart from the harmony of furniture with humans, proportion and scale is another factor that influences the aesthetics of furniture formation. The golden ratio is without a doubt the most influential in furniture design. Triangulation is another ratio system used. The relation with fixed fittings in typical Turkish houses with human size and function is the best example of scale. When designing the Modulor ratio scheme, Le Corbusier is said to have been influenced by this scale-proportion aspect of the traditional Turkish House (Figure-17) (Demirarslan & Demirarslan, 2020).

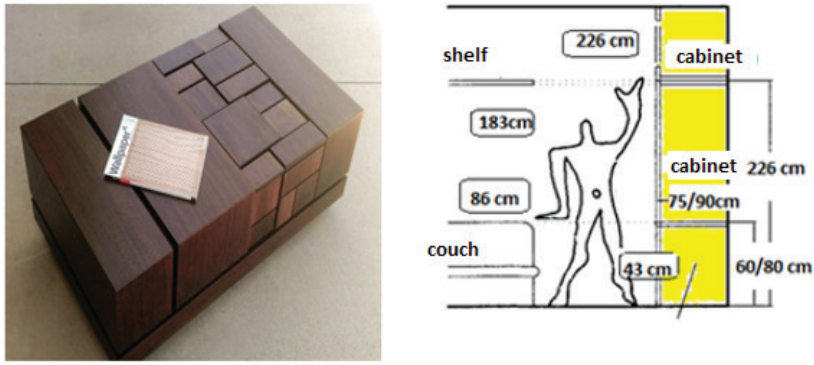

Figure 17. A Coffee Table Designed According to the Golden Ratio and Fibonacci Sequence (URL-20); Human-Scale and Proportion Relationship in Traditional Turkish House (Demirarslan & Demirarslan, 2020).

5.9.Design Styles:

Besides that, distinct design styles that originated at different times are seen as a significant influence on furniture design due to their design lines and features. For example, while excessive curves, the use of gold leaf, and the use of exotic woods such as mahogany influence the shape of Baroque furniture, feminine lines dominate the style of Art Nouveau furniture. The manifesto "Form follows function" affects modern furniture, while the manifesto "Function follows form" has been successful in postmodern furniture.

5.10.Aesthetics, Design Elements and Principles:

Aristotle, the Greek philosopher, described aesthetics as proportion, harmony, and order. A design must include design elements and principles to be considered aesthetic (Warry, 2014). Line, shape, color, texture, place, structure, and value are design elements, while harmony, rhythm, focus, movement, contrast, honesty, and alignment are design principles. Aesthetic products occur when a number of these elements and principles are combined in a certain order. The necessity of using these elements and principles differs greatly depending on the design style (Figure-18).

Figure 18. Karl Lagerfeld's House in Monte Carlo and Postmodern Furniture (URL-21).

5.11.Hierarchy, Status and Identity:

In the early period of history, furniture was accepted as a sign of high status in society because the furniture was not easily available to all segments of society. It was the products used by a certain group, such as the nobility, the rich, and the clergy. As symbols of hierarchy, ornamental components such as furniture elevations, exaggerated ornaments, and predator/claw figures were used. Similar features are seen today. Similarly, furniture can help determine a user's cultural identification, social identity, and even the identity of the place where it is used. For example; The thrones of the country rulers are higher than the normal seat and backrest height and have an elevated platform beneath them. This situation is all about hierarchy, status, and identity. However, Mies van der Rohe surprised the design world in the seat he designed for the King of Spain to sit at the Barcelona Pavilion. The hierarchy, status, and identity of the furniture he designed made it unique and strong by using materials and technology extraordinarily according to the day's conditions (Figure- 19).

Figure 19. Throne of the Assyrian King on the Left; the "Barcelona Chair" on the Right, Designed by Mies van der Rohe, 1929 (URL-22).

Another important example that reflects the social identity of furniture is Shaker Furniture. It is an example of functional furniture that reflects the simple and modest life of the Shaker society[6] (Figure- 20).

Figure 20. A Shaker House and Furnishings (URL-23).

5.12.Economics:

Features such as modularity, flexibility, and multifunctionality have been taken into account in furniture design to obtain the furniture that people need in their homes, particularly since the second half of the twentieth century, as a result of rapid population growth. Practices such

6 They created a self-sufficient lifestyle by producing all kinds of materials necessary for life, carrying functionality, simplicity, and beauty.

as the advent of do-it-yourself[7] furniture, the abundance of shops that sell this furniture disassembled, and the recycling of old furniture, on the other hand, are motivated by financial considerations.

6.Conclusion

The number of factors that influence furniture design can be increased. The key elements have been summarized in this chapter. The important thing is to consider the aspects that shape the furniture as a whole. If only one of these factors is taken into account, ignoring the other factors will lead to a weak design.

For example; two chairs used in residences are shown in Figure-21. The first chair was designed to meet the sitting requirement only, considering the sitting action and its dimensions. Other factors haven't been taken into account as much as they should have been. The second chair is a Thonet design. It is an example of a product that has been designed with multiple aspects in mind, including technology, material, design style, ergonomics, consumer preferences, and aesthetics.

Figure 21. The Difference Between a Chair Designed with Only Needs and Function in Mind and a Thonet Chair.

Furniture, which is an essential part of our everyday lives, can be assessed by looking at the historical period used, social life, geographical location, and technology. Furniture designated and functionalized according to its use fields has been used as status symbols or artifacts that characterize the user's taste in addition to their functions throughout history. Furniture has been inspired by changes in other aspects of culture, shaped by manufacturing and consumption concepts, and introduced many advancements in the evolution of furniture, which has reached today.

7 Do-it-yourself means producing something on its own at home, replacing or recycling an existing product without requiring being an expert on a subject or getting help from any specialist.

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Chapter 3

ECOLOGICAL CONFIGURATION AT GLAMPINGS IN THE CONTEXT OF SUSTAINABILITY - REVIEW AND PROPOSAL OF A DESIGN MODEL

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The data in this study is based on the PhD thesis entitled: *"Konaklama Mekânlarında Ekolojik Biçimleniş ve Bir Tasarım Modeli Önerisi",* supervised by Prof. Dr. İpek Fitöz at Institute of Science and Technology, Mimar Sinan Fine Arts University in January 2017.

1. INTRODUCTION

Nature has been a major factor in space planning since the existence of human being. Form and functions in architectural design has been interacted with nature in time and the principles that imitate or reinterpret nature have occurred. Due to the anthropocentric relationship established with the environment in the past, natural habitats have been destroyed and the usage rate of fossil fuel consumption in buildings has also increased. Today, one of the most important reason that causes global warming is architectural designs that are not interacted with nature (İmert, 2017).

Technological development impacts the daily life of society, consequently it transforms the space planning functionally. Accordingly, urban mobility and the movement caused by transportation improvements increases the levels of migration due to security concerns and economic reasons. Rural to urban movement affects social experiences of urban natives (Ekici & Tuncel, 2015). People want to reconnect with nature in order to get rid of their negative social experiences, which causes the diversification of demands at tourism accommodations. Experiencing the unspoilt nature and wild life is stressful, so people who are accustomed to luxury and comfort in cities and also complained about the difficulties of camp life increase the demand for glamping facilities (İmert, 2017; Sakáčová, 2013). The global glamping market size was valued at 2,1 billion USD in 2018 and expected to expand at a compound annual growth rate (CAGR) of 12.5% from 2019 to 2025 (Market Analysis Report, 2019). In addition, it is obvious that the demand will also increase for glamping in new normal after the COVID-19 pandemic. Glamping Hub, which is a booking site with more than 24,000 glamping destinations in 115 countries, had a revenue from July through August up about 250% from the year-earlier period in 2020 and %25 of total campers between May 1 and September 30 were first-timers (GlampingHub, 2021; Mitchell, 2021).

Despite all the increasing demands on the glamping market, the majority of potential ecotourists do not have particularly green values and motivations to protect the natural environment (Blamey & Braithwaite, 1997). Furthermore, people who visit nature-based tourism attractions and destinations are not necessarily interested in the activities related with nature (Mehmetoglu, 2007; Sakáčová, 2013). Providing luxury requirements is very important in terms of customer satisfaction (Marangoz & Akyıldız, 2007). For this reason, anthropocentric design outputs shaped by customers' luxury expectations cause some inevitable problems (İmert, 2017).

This study based on a PhD thesis entitled *"Konaklama Mekânlarında Ekolojik Biçimleniş ve Bir Tasarım Modeli Önerisi"*. The literature review shows that there is a lack of studies investigating the problems created by luxury-oriented glamping designs without an interaction with nature on

design stage. To fill this literature gap, this paper identifies an ecological and sustainable process matrix on a design model proposal. Due to some disadvantages and constraints of certification systems such as LEED, this combination matrix is proposed as a template to solve problems on an isolated evaluation of design with strenuous tasks (İmert, 2017; Tolksdorf et al., 2014). Simplified steps of the combination matrix are evaluated on the design model, so the model proposal is considered as the output of the ecological and sustainable process matrix.

2. CONCEPTUAL BACKGROUND

2.1. Defining Glamping

Glamping is a mixture of words *'glamorous'* and *'camping'* and defined as a type of camping that is more comfortable and luxurious than traditional camping (Cambridge Dictionary, 2021). Glamping sites offer 5-star camping facilities with different type of accommodations: safari tents, tipis, yurts, huts, cabins, tree houses, caravans etc. (İmert, 2017; Sakáčová, 2013). Glamping are also places where nature meets luxury and they might open a new chapter in global tourism development in near future (Cvelić-Bonifačić et al., 2017).

Although glamping is a popular type of accommodations recently, the early samples in different forms were seen in Ottoman Empire period (İmert, 2017; Sakáčová, 2013). Especially, tents were widely used in military campaigns, ceremonial occasions and celebrations by Ottoman sultans and their subjects since the empire was founded in 1299 (GlampingHub, 2019; Turkish Cultural Foundation, 2021). Ottomans used to build luxury tents *(Otağ-ı Hümayun)*, richly decorated with resembling tiled panels usually in floral patterns, gold, silk carpets, gemstones and other expensive materials. The interior designs of the sultan tents were made in an eye-catching manner and there were specially trained masters to build them (Çürük, 1993; Sakáčová, 2013). In this direction, ottoman tents could be considered as a beginning of glamping (İmert, 2017; Sakáčová, 2013). In 20th century, African safari became very popular and safari tents were well-equipped with the luxuries. After that, economic crisis hindered foreign travels in 1990s. The right to tow a caravan was removed from U.K. driving license in 1997, and people had to start looking new alternatives to go on a holiday. Glamping is incidentally invented with the little camping experience and existing hotel experience of the society (GlampingHub, 2019).

2.2. Motivation of Glampers: Luxury Demand

Customer demands and motivations are the most decisive factor in glamping market. Especially in the 1990s, it is observed that the importance given to customer-oriented or customer-centered approaches have increased. In line with this understanding, it is foreseen that the system is based on

the customers instead of manufacturers or operators. Over time, companies have started to shape their organizations according to customer expectations (Güler, 2009). The motivation of glampers is mostly settled on to escape from the daily social routines of the urban life and experience the nature without the difficulties of camping (İmert, 2017; Sakáčová, 2013).

Luxury demand is also very important to understand the motivation of the glampers. As result of a general belief, people's income levels are associated with luxury consumption. In addition to these symbolic and social values, culture is also considered as a part of luxury consumption (Elliott, 1997; İmert, 2017). Luxurious and high class service in glamping accommodations is related to customer loyalty and satisfaction. In this direction, concentrating on luxury demands in glamping facilities constitutes the service goal to ensure customer loyalty and satisfaction (İmert, 2017).

2.3. Motivation of Glampers: Interaction with Nature

The concept of ecotourism is defined as a reliable type of tourism that increases the economic prosperity of the local people by protecting the natural environment and resources (UNWTO, 2002). Glamping could be considered as a type of ecotourism for similar reasons. The ecotourists that interact with nature can be evaluated in three motivation dimensions; excitement, socialization, and family togetherness. In addition, the group of individuals who prefer ecotourism, are attracted by beauty of destinations and seek for comfort/satisfaction (Meng et al., 2008). Camping usually takes place in the nature. In this direction, it is clear that doing camp activities with good standards is not a subtractive factor in interaction with nature (İmert, 2017).

3. METHOD AND SCOPE

The ecological footprint process envisaged in this study is based on 4 main approaches in 2 stages. This ecological and sustainable design process matrix *(combination matrix)* has been prepared with the aim of reorganizing the design processes shaped by building/interior scale, financial statements and customer demands. The process matrix defines the design phases which contains simplified steps to be used as a design template.

3.1. Phase One: Morphological and Functional İnnovation

Morphological and functional innovation phase aims to benefit from biomimetic and traditional architecture approaches. Simulating the form or natural process is considered to constitute the first level of biomimetic design (Benyus, 2021). Biomimetic based solutions for nature friendly design includes a wide range of tools and methods (İmert, 2017). However, these inspirational approaches are not only based on the imitation of forms or patterns, it is also necessary to imitate processes or systems occurring in nature (Benyus, 1997). In this way, nature inspired design thinking

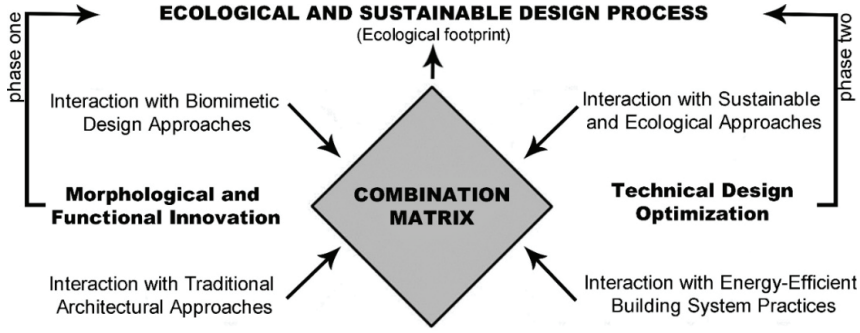
becomes a starting point for creating biological solutions to problems encountered in architectural and interior design practice (İmert, 2017). Transferring the patterns in nature to design stage constitutes an important part of the innovation process.

On the other hand, traditional architecture includes artificial outputs developed in order to adapt to the environment through trial and error methods from past to present. Taking advantage of these approaches, which is characterized by local climatic conditions, use of local materials and simple structures, reveals designs balanced with nature. Strong relationships established with the living environment and nature cause the diversification of traditional architectural practices. With all these aspects, flexible designs emerge to contribute to social and cultural development (Şenoğlu, 2003). Considering their interaction with nature, the coordination of biomimetic and traditional architectural practices constitutes the backbone of the combination matrix.

3.2. Phase Two - Technical Design Optimization

Technical design optimization process aims to provide solutions to meet comfort needs in the context of sustainability. Second phase could be understood by the relation of eight key practices; thermal comfort, energy efficiency, water efficiency, indoor air quality, use of recycled materials, waste management, green architecture and natural lighting. These practices are generally accepted principles for sustainability and nature conservation, which are mostly measured in certification systems such as LEED and BREEAM (Anbarcı et al., 2012; Çakmanus et al., 2010; Olgun et al., 2009). In order to support technical design optimization process, energy efficient building practices such as Passive Houses and Earthships are used to strengthen the technical infrastructure. According to the research method, the model proposal is examined and analyzed using the ecological and sustainable design process matrix (figure 1).

Figure 1. *Ecological and sustainable design process matrix (İmert, 2017).*



4. PROPOSAL OF A DESIGN MODEL: DESCRIPTION AND ANALYSIS

4.1. Interaction with Biomimetic Design Approaches

Building envelope design has been completed by examining the forms, structures and patterns in nature and inspired by the cactus plants which are well adapted to dry regions and hot climates. Cacti reflect light and create shaded areas with form of their leaves, thus reducing loss of water. (Sajeva et al., 2012). The shaded areas created in the building envelope with bioplastic panels were inspired by cactus plant. The forms and patterns used in the process of inspiration from nature are given below (figure 2).

Figure 2. *Interaction with biomimetic approaches of model proposal (İmert, 2017).*

4.2. Interaction with Traditional Architectural Approaches

Wind Catcher, which is frequently encountered in traditional architectural applications, is used in the design model proposal in order to provide natural ventilation and indoor air quality. The orientation of the wind tower is generally determined according to four main geographical directions. This function is important for capturing the wind blowing in different directions (Maleki, 2011). The chimneys of wind catchers are mostly in the form of an incomplete pyramid and there are air ducts on

the upper part to catch wind (A´zami, 2005). The wind catcher is designed in a conic form in order to provide a design integrity and harmony with the geometric forms in nature. The wind catcher is based on two basic operating principles at night and during the day. The air rise through south direction of the chimney wall during daytime. At night, air circulation is provided with the temperature difference that occurs indoors and outdoors. The working principles of wind catcher during day and night hours are given below (figure 3).

Figure 3. *The working principles of wind catcher during day and night (İmert, 2017).*

4.3. Interaction with Sustainable and Ecological Approaches

The design model establishes an integrated link with ecological and sustainable design principles. The underfloor heating system connected to boiler works with solar energy in order to provide thermal comfort level of the air which is transferred to the interior from the wind catcher. Heat pump can also be added to the system for suitable lands. Indoor thermal comfort is created by circulating hot water pipes around the floor. The section of underfloor heating with boiler is given below (figure 4).

Figure 4. *The section of underfloor heating with boiler (İmert, 2017).*

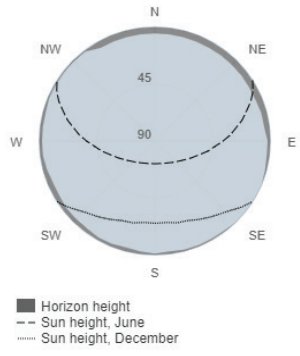
Photovoltaic (PV) Performance Tool is used to determine the energy needs. İstanbul is selected as a reference city for calculations. According to PV Performance Tool (figure 5), it is observed that 168 kW of energy was produced during month of July with the solar panel system which is producing an average of 1 kW. Therefore, the daily energy need is determined as 168 kW / 30 (days) = 5.6 kW. In the light of these calculations, the effective use of the sun is considered as 6 hours. 1.35 kW / hour of energy is collected with 9 solar panels that produce 150 watts of energy including periods of no sunshine. The average daily energy production amount will be 8.1 kW, but it should not be forgotten that the amount of sunshine varies according to seasonal conditions. Energy production will be stored in batteries before being used in glamping. Period of no sunshine is considered as 1,5 days while choosing the battery types. In this way, 8.1 kW x 1,5 (days) = 12.15 kW energy will be stored in batteries. Energy needs could also be supported with urban electricity networks if the land is suitable. Section of energy generation and storage from solar panels is given below (figure 6).

Figure 5. *PV Performance Tool energy and solar irradiation results (PVGIS, 2021).*

Monthly PV energy and solar irradiation

Month	E_m	H(i)_m	SD_m
January	64.3	76.1	13.7
February	62.8	75.5	11.5
March	105.0	127.5	10.7
April	129.2	160.4	18.0
May	149.9	191.4	10.4
June	152.0	198.8	13.8
July	168.0	220.2	6.0
August	160.4	209.7	6.2
September	124.5	159.7	11.9
October	90.3	113.3	13.5
November	70.2	85.5	14.2
December	57.4	68.9	9.3

(a) Monthly energy output from fix-angle PV system



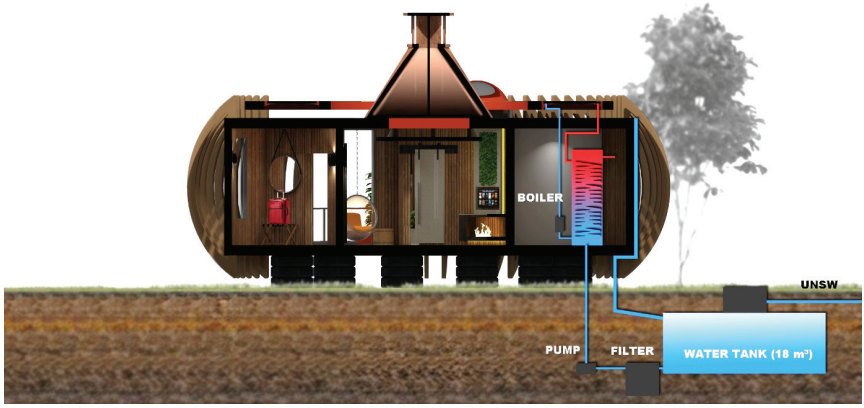
(b) Outline of horizon at chosen location

Figure 6. *Section of energy generation and storage from solar panels (İmert, 2017).*

Glamping hut's water needs are provided by the rainwater harvesting. The rainwater is collected from the roof, which is also filtered in the underground fiberglass tank, and delivered to the hut by a pump. Requirements for water needs are determined according to TS 1258 standards.

The calculation method of Turkish standards is as follows; 90 liter/day x person at hotels with shower and 150 liter/day x person at hotels with bathtub (TSE, 1983). Considering that there will be families in the glamping hut, it is calculated as 150 (l) x 30 (day) x 4 (person) = 18.000 liter *(18 m³)*. The glamping hut's water management strategy is not only off-grid, there will be options to connect urban water supply network (UWSN) if the land is suitable. Section of rainwater harvesting is given below (figure 7).

Figure 7. *Section of rainwater harvesting (İmert, 2017).*



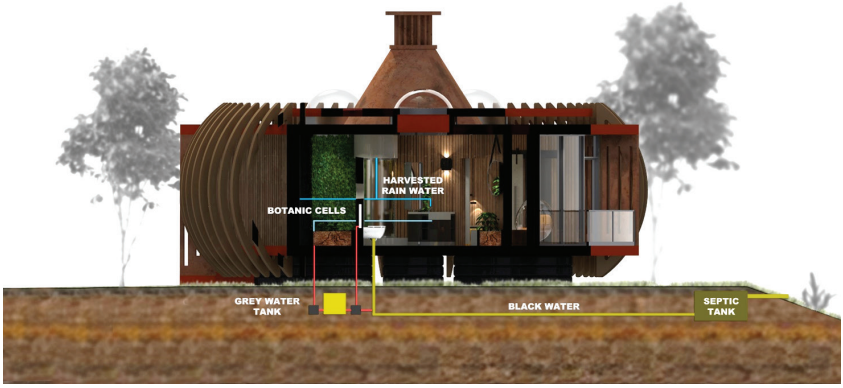
Recycled or recyclable materials are mainly used in the design model proposal. In addition, the use of materials that make cleaning difficult and unpleasant in the interior has been minimized. The list of recycled/recyclable and compostable materials is below (table 1).

Table 1. *The list of recycled/recyclable and compostable materials (İmert, 2017).*

Exterior		
Area or Type	**Material**	**Status**
Main Structure and Walls	Wood	Upcycled
Wind Catcher	Weathering steel	%70,2 recycled
Façade solar shading	Bio-plastic	Compostable
Interior		
Area or Type	**Material**	**Status**
Wall Cladding	Wood	Upcycled
Flooring by Fiandre	Marble	%40 recycled
Flooring by Mohawk	Carpet	%100 recycled
Surfaces	Acrylic Modified Polyester High-Density Fiberboard (updated)	%6-20 recycled %10 recycled
Upholstery by Brentano	Fabric	%37 recycled polyester

Harvested rainwater will be used three times at kitchen and bathrooms in order to provide waste management. Gray water will be filtered and transferred to the toilet flushing. In the last stage, the black water of the toilet will be transferred to the septic tank. Black water is used in plant production. Section of waste water management system is given below (figure 8).

Figure 8. *Section of waste water management system (İmert, 2017).*



4.4. Interaction with Energy-Efficient Building System Practices

The basic principles of rainwater harvesting and water conservation, which are also used in Earthship Biotecture, are applied to the design model (figure 7&8). In addition, automobile tires that are waste in nature are used as a rigid block to support glamping hut. Recycled tires are main structural building component of Earthships. Besides, low e-glazing windows and direct gain passive solar system principles are also used (İmert, 2017). In this direction, it is ensured that different energy efficient building approaches are integrated in the design model proposal.

4.5. Analysis of Design Model

As a pilot study, it is envisaged to design a hut because of their high safety possibilities and availability of ample amenities, such as lockable doors and windows, kitchen, bathroom, living room, etc. (Market Analysis Report, 2019). It is aimed to provide comfort requirements and luxury demands of the customers within the glamping hut. Spatial planning is developed by transforming the open plan concept of Sultan tents into a glamping accommodation and using the fireplace instead of open fire. Spatial planning and conceptual background is examined on an evaluation table, it is seen that the phases including morphological and functional innovation and technical design optimization are combined successfully. Combination matrix evaluation table of the design model is given below (table 2). The content of combination matrix evaluation table includes the scale and boundaries of the design model proposal.

Table 2. Combination matrix evaluation table (İmert, 2017).

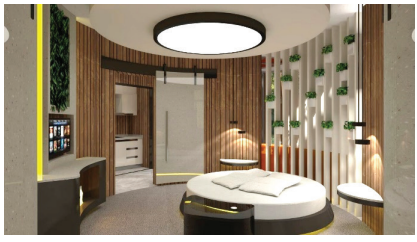
CONCEPTUAL BACKGROUND	**DESIGN MODEL PROPOSAL**
1- Sultan Tents of Ottoman (Open Plan Concept)	1- Adaptation to Glamping Accommodation (Hut)
2- Open Fire in tents	2- Fireplace
SPATIAL PLANNING	
Phase One - Morphological and Functional Innovation	
Interaction with Biomimetic Design Approaches	▪ Inspired by cactus in nature ▪ Inspired by crystal forms in nature for bio-ethanol fireplace
Interaction with Traditional Architectural Approaches	▪ Wind Catcher
Phase Two - Technical Design Optimization	
Interaction with Sustainable and Ecological Approaches	▪ Thermal Comfort ▪ Energy Efficiency ▪ Water Efficiency ▪ Indoor Air Quality ▪ Use of Recycled Materials ▪ Waste Management ▪ Natural Lighting ▪ Green Architecture
Interaction with Energy-Efficient Building System Practices (Earthship Biotecture and Passive Houses)	▪ Re-Use of Waste Tires ▪ Low E-glazing Windows ▪ Direct Gain Passive Solar System

Natural light is gained with skylights on the roof to reduce air conditioning costs. Frame insulations and heating problems are solved with low e-glazing windows and direct gain passive solar system practices of energy efficient buildings such as Passive houses. Wet areas respond to reduced energy demands of glamping. Energy needs will be provided by the solar panels, and the water requirements by harvested rainwater from the roof and on the ground. Gray and black water systems are used in the glamping to increase water conservation and efficiency. Indoor air quality has been improved with the quality of material surfaces and natural ventilation solutions provided by the wind catcher. Bioethanol fuels, which do not harm the nature, will be used in the fireplace in parallel with the strategies to save the waste tires into economy. The glamping contains elements of green architecture on its roof and interiors. All requirements have been realized in the light of user-oriented adaptable calculations.

Figure 9. *Design model proposal with interior renderings (İmert, 2017).*

(a) Exterior of the glamping hut

(b) Plan



(c) Bedroom

(d) Living Room

5. LOOKING FORWARD: IMPLICATIONS AND FUTURE STRATEGIES

This study focuses on problems of glamping accommodation needs in today's world and the environmental problems that arise parallel to it. Certification systems are open to discussion since they bring various constraints along with the advantages they provide in combating global warming. These constraints lay down the requirements to develop new

alternative methods. Template of the design principle matrix, which is created by Parvan, Schwalmberger and Lindemann in 2011, is used for combination matrix in this study. However, design principle matrix is only focused on solution searchs in biomimetics and evaluates the process on technical, biological and biomimetic principles (Parvan et al., 2011). In this study, ecological and sustainable design process is based on the combination of biomimetic approaches and traditional architectural practices in the first phase. This combination will facilitate the use of the design process matrix including DIY projects because of easy and economical application methods of traditional architecture. In addition, aesthetic elements that are not considered in traditional architecture are increased by biomimetic approaches.

Nature conservation is the main goal in sustainable and ecological design processes. However, the additional costs of certification systems make it difficult to manage the design and application processes (İmert, 2017). As an example; having a platinum degree within the LEED certification system requires a high additional costs to be added in project budget. It is also known that high unit price differences occur between LEED rating levels (Uğur & Leblebici, 2019). In addition, building/ interior design construction fees and the employment of green building experts cause additional budgets to financial statements (Somalı & Ilıcalı, 2009). Considering those financial statements on detailed and strenuous certification processes, it is obvious that clients behave arbitrarily to request certified projects (İmert, 2017). According to the design outputs of this study, it is predicted that the sustainable and ecological design process matrix will be beneficial as a simplified process template for nature conservation starting from design stage.

Certification systems mainly focus on technical parameters such as energy/water efficiency, indoor air quality, sustainable lands, etc. in limited geographical conditions, which also reveals another important constraint. As an example, taking the United Kingdom as a reference while creating categories in BREEAM reveals various problems regarding its applications in other countries (Somalı & Ilıcalı, 2009). Building Research Establishment (BRE) has tried to eliminate these problems by releasing global versions of BREEAM since 2008. However, it is seen that a single technical standard scale is used for all other countries within these global versions except some European countries and the United States of America (BREEAM, 2021). It will be possible the implementation of designs in all geographical locations via design process matrix in this study, starting from the drafting phase with the combination of biomimetic approaches and traditional architectural practices (İmert, 2017). The outputs obtained in parallel with the innovation process in the study are supported by

technical design optimization practices. It is observed that the technical design optimization, which is the second phase in the design process matrix, based on sustainable technical design practices while creating a mixed model with the methods of energy efficient buildings.

Another important factor affecting the stages of the design process is the customer motivations which are not interacted with nature. It is of great importance to raise the awareness of the society about the protection of nature while developing future strategies. In this direction, sustainability and ecological design methods should be included in the education curricula at faculties of architecture. In this way, it will be more likely to observe an increase in designs that have a relationship with nature. The use of ecological design elements in fictional spaces may also be beneficial in order to increase the perception of nature in the memory of the society. State policies should be developed, the authorities of professional associations should be regulated at the point of sustainable design, and private companies should be aimed to work in connection with supervisory institutions for solutions of these problems. In addition, public awareness and encouragement should be ensured through national/international competitions, exhibitions and seminars which are related with nature conservation.

6. CONCLUSION

This paper has examined a model proposal, using the ecological and sustainable design matrix based on biomimetic and traditional architectural approaches combined with energy efficient strategies, to determine possible results - especially for scale of glamping accommodations. The referenced data in this research shows that motivational demands for glamping accommodations are increasing day by day. However, providing the luxury demands of the customers with nature-friendly service is very important in the fight against global warming. In addition, it is also crucial to provide the spatial experience aiming at the environmental protection in conceptual planning. Model proposal has been designed with luxuries in order to ensure the reflection of the targeted visual awareness level on customer demands. Combination matrix is offered to shed light on the work of experts to solve environmental problems occurred at glamping accommodations in today's world. In this direction, it is foreseen that the design model could be positioned at geographical points that will meet customer expectations in order to reduce time and financial losses. The strategy of providing luxury design elements with the use of waste materials reduce construction costs. Energy efficiency strategies also reduce the costs by cutting total volume of electricity and water that a glamping must draw. In the light of these approaches, it will be contributed to ensure customer satisfaction, improve the image of the glamping facilities and provide satisfaction of the stakeholders.

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Chapter 4

A STUDY ON THE DISTINCTION BETWEEN MODULARITY AND PREFABRICATION BUILDING METHODS

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INTRODUCTION

Modularity is the stage to which the components of a system may be separated and recombined with each other. By using specific units, it offers new and clear solutions for todays' architecture and furniture design stages. However, whether modular systems only work with the systematical modules to create a specific unit, knowledge and usages of modular construction can be questioned because of the lack of modular knowledge and the drowning knowledge of prefabrication. Prefabrication is a complete system production and on-site application of the created units of modules. Socially, not only in architecture, but also in other design terms, prefabrication and modularity notions are drawn to each other. With the help of researches and surveys, this study shows readers the real mean and notion of modularity with its distinctions from prefabrication.

In literature, researchers are generally talked about history of modularity, history of prefabrication and their evolutions and their actual stands under the same subheadings. But, these two concepts need to differentiate from each other. To clarify the details of these concepts, the histories of the subjects should be examined. It comes with the modular design evolution in architecture to show the how modularity becomes useful in architecture and is it really necessary for architects and manufacturers. Although the development of prefabrication was appeared simultaneous with the modularity, due to the impact of factory production processes in recent years, the widespread use of prefabrication is not an old production process. Regardless, modules and the modularity are the initial point of the issue.

In this chapter, it is aimed to eliminate the confusion between modularity and prefabrication. Thus, the meanings and systematical differences of the concepts of modularity and prefabrication in the fields of architecture and design takes an important role. In this context, firstly the concept of modularity will be explained, then the concept of prefabrication will be evaluated and the differences between them will be compare through the literature. Afterwards, it is going to be discussed the case structures within the scope of modularity and prefabrication in design.

HISTORY OF MODULARITY IN DESIGN

In nature, modularity refers to the construction of a cellular organism by joining together standardized units to form larger compositions. Originally, the term 'module' comes from ancient time, where the Latin Word 'modulus' was a measure of length. Routio (1998) mentioned in the article that; 'it was described already by Marcus Vitruvius Pollio (Vitruve), who worked under the Roman emperor Augustus. He wrote in his 'Ten books on Architecture' (De architectura libri decem) about laws on proportions and symmetry in temples and columns.' The module was a standard measure

ensuring the right proportions. For instance, the hexagonal cells in a honeycomb are a good and the basic example for a module. (en.wikipedia.org). The honeycomb combination can be seen in the Figure 1 as below

*Figure 1. Honeycomb that comes together and creates a modular shape (*http://designfundi.com/projects/wikidell/browse-designs/honeycomb-shelf/*).*

Especially, using modules in products and utilizing benefits of modularity in structures are developed as a practical design work in the industrial history of the 20th century. As Lehtonen (2007) states that; 'In the practical industrial operations, modularity is not, of course, defined, but the word is used in connection with products with defined internal interfaces between assemblies. Occasionally, this has been associated with the idea of interchangeable modules and the configurability of the product, but it is not always the case. Also, as Lehtonen (2007) continues his statement as; 'Products labeled modular in the industry share the fact that they feature an internal division or divisions based on some more abstract reason than the general component structure'.

Although the modular concept was initially used in production, it also brought some confusion about processes and systems because it could not be established on a solid basis. Miller (2005) argues this problem as: 'Modularization is currently in focus as a mean for increasing competitiveness of industrial companies. This is achieved by bridging the advantages of standardization and rationalization with customization and flexibility. But the phenomenon behind modularization itself is not very well described and understood in literature'.

In fact, accepting the concept of modularity as a diversity or a set of diverse systems will be enough to eliminate all this confusion and improve the production processes in design. In literature, there are many statements that argue this confusion by perceiving the diversity correctly. As Lethonen (2007) states in the article that; 'Modularity as a phenomenon is divided into two categories; variation related modularity and modularity related to the life cycle of the product. With the identification of modules variations, both design and construction principles influenced from this consciousness and started to use and develop the modular knowledge.'

However, the original geometrical definition of modularity is no longer identified clearly in the literature, as mentioned above, the concept of diversity should be considered as a very important concept especially using modules for design processes. Because, modular consciousness cannot be established with a solid definition for design processes in the literature, it is generally tried to be explained through production processes.

As Ulrich & Tung mentioned in their article that; 'the original measurement module has been connected to the idea of industrial building blocks carrying functionality and also, in the later years, to immaterial things like software and knowledge. Therefore, it does not seem reasonable to limit the definition of modularity to physical entities, as it is seen in large parts of the mechanical technical literature, e.g.,' As mentioned at the beginning of the chapter, this situation causes the modular concept to be confused with prefabrication.

HISTORY OF PREFABRICATION IN DESIGN

Basically, prefabrication can be determined as a construction method. Smith (2009) identifies the prefabrication as; a method of production in housing that has been harnessed to meet the needs and desires of different societies through the globe. Additionally, prefabrication had been used from ancient times. As Martiini (2009) mentioned that; 'From the time that humanity started, prefabrication technique (site-built) has been the chosen form of shelter for much of the natural world. The natural world, it turns out, is clever in that its citizens frequently rely on their neighbors or ancestors or their own biological functions to provide shelter (when there is any required)'. Also, Martiini (2009) gives some example for the prefabricate organizations as 'Natural examples of site-built housing' like bird's nests, spider webs, ant hills, etc. but even in these cases the tendency is to use materials that have already undergone fairly elaborate manufacture to bring them to their useful state such as sticks, silk, sand, trees'.

Additionally, in the manufacture, the earliest prefabricated system was used in 1624 when houses were prepared in England and sent to the fishing village of Cape Anne in what is now a city in Massachusetts' Arieff (2002). After the prefabricate systems used for housing, in the late 1700's it is reported that the earliest settlement in New South Wales to build prefabricated hospital, storehouses and cottages shipped to Sydney. For prefabricated building systems it was important to have a portable manufacturer system (Figure 2).

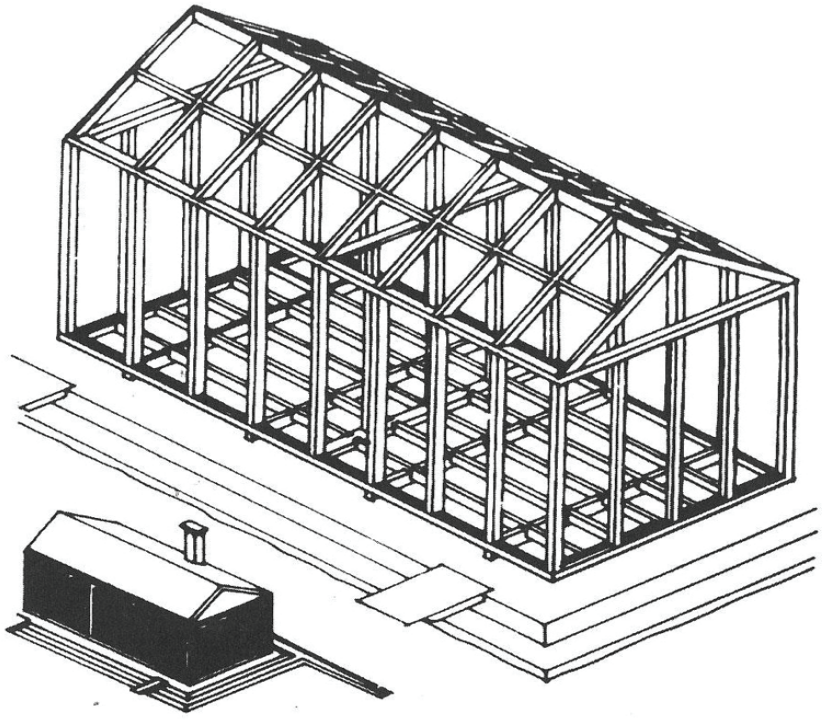

Figure 2. Manning Portable Colonial Cottage manufactured in Great Britain and shipped to colonies throughout the world (Smith, 2009).

As being seen from the figure 2, prefabrication notion is generally referred to housing system in site. When the prefabrication notion is considered as an on-site procedure for the construction phase. Also, it can be said that; modularity and prefabrication concepts are coming together under the mass customization title, except of principles of structural systems. Mass customization can be described as a marketing and manufacturing process which combines the flexibility and personalization of custom-made products.

Additionally, mass customization which aims to develop fast production, is used effectively today in industrial design. Jacobs (2007) states in article that; 'For example, Toyota automobiles, Dell computers, 11 and Nike shoes divide the manufacturing process of their products into two primary parts: a base model with features included that are considered necessary, and auxiliary features that are available for inclusion based on the demand of consumers'.

CASE STRUCTURES WITHIN THE SCOPE OF MODULARITY AND PREFABRICATION

In accordance with the written information below, it can be said that modularity is a production system directly linked to the function and multiplication. By the way, prefabrication is an on-site technique which reproduce architectural constructions like building block ideas. Indeed, in the architectural scope, using modularity and prefabrication concepts in the same constructional phase can increase the quality of the project by developing practical systems and saves time in the site by reproducing the modules before on-site procedure started.

In this scope, The Habitat 67 and MDU houses are selected to compare their production and on-site reproduction techniques to understand whether if they are modular or prefabricated. Additionally, the term terminal related with the containers which is used as a partition inside of the buildings is going to discus to identified the various modular design systems.

Habitat 67

Habitat 67 is a residential complex built for the 1967 International and Universal Exposition in Montreal, Canada (Figure 3). Project designed by Moshe Safdie which successfully internalizes a suburban condition in an urban context.

*Figure 3. Map of the Habitat 67, Montreal, Canada (*https://mostlymontreal.com/first-dates/habitat-67-parc-de-la-cite-du-havre-perpetual-wave/*).*

Safdie (1970) who is the architect of the project states that; 'The complex is an arrangement of a much of identical 'precast concrete' volumes fit together in a number of different arrangements to create a monolithic landmark for the city.

Using about five different shaped module structures which every module has a private garden, commands its individual presence despite the

compact nature of the cluster of modules because of the interstice spaces created by rooftoping their layout. Communal spaces including parks, shops, and even movie theatres are dispersed through the complex'. The design stages of Habitat 67 can be seen from the Figure 4 as below.

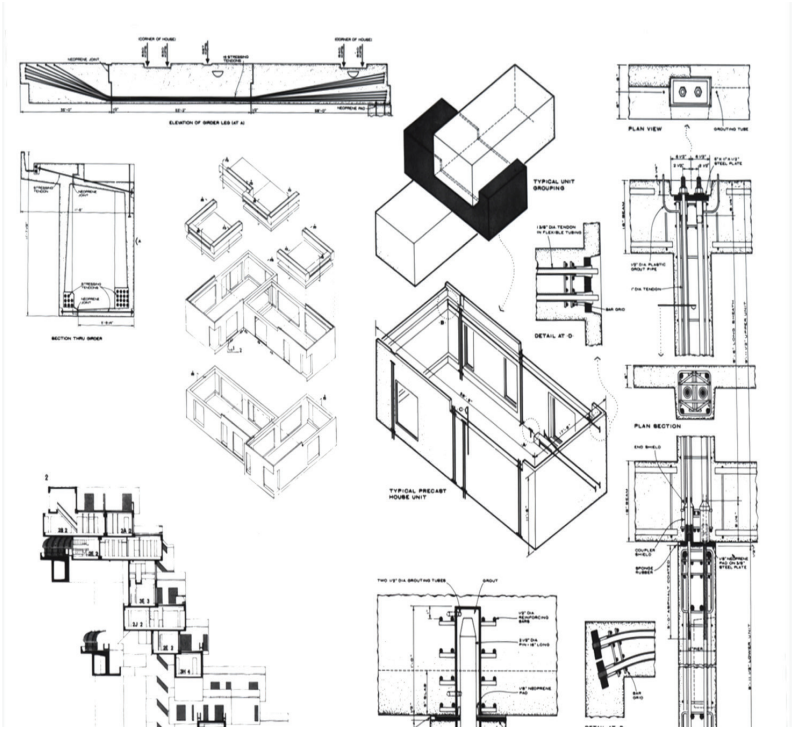

Figure 4. Design and construction details of the Habitat 67 (https://www.arkitektuel.com/habitat-67/).

As can be follow from the figure, main concrete blocks are the main design element of the project. These precast concrete block modules can be attached or detach to each other in some different way with a specific modular construction method. Additionally, according to the designed precast concrete components of the Habitat 67, blocks which attached in a different way, can needs different ceiling slabs. So, with the help of the modular idea, different modular ceiling slabs produced in the factory, transported to the site and constructed. It can be followed from the figure 5.

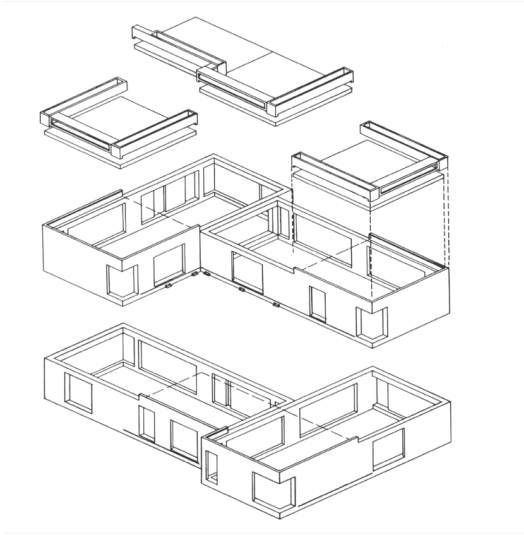

Figure 5. Modular precast concrete ceiling slabs of the Habitat 67 (https://www.arkitektuel.com/habitat-67/).

The concrete block modules are prefabricated at the off-site and transported to the site. After the transportation phase is done, concrete blocks were started to settled on-site by using lifting vehicles as planned before. The on-site construction stages can be followed from Figure 6.

Figure 6. The on-site construction stages of concrete modular blocks by using lifting vehicles (https://www.arkitektuel.com/habitat-67/).

Considering the Habitat 67 example, the project and production process of the building was completed with modular discipline, and then the construction was completed considering the prefabricated consciousness.

The MDU House

The MDU House is a modern perspective of the Habitat 67 and it is more easy and light form of the same modular discipline. It differs with the material selection. Habitat 67 is a precast structure but the MDU house is an ideal metal structure. As Hartley and Blagden (2007) mentioned that; 'Modular construction would seem to be ideal for urban infill sites because onsite construction can be completed in phases allowing the surroundings buildings to be relatively undisturbed. The challenge, however, is that high-value "flagship projects" like large office developments would be undermined by the introduction of the limitations of modular construction'.

But, though by no means prevalent, the challenge is being undertaken today by large architectural firms like SHoP Architects (Atlantic Yards in New York), or O'Connell East Architects (Victoria Hall in Wembley, UK). As Herbers (2004) states that; 'The New York based firm Lot-Ek, in particular, pushes the re-use of shipping containers as modular building blocks in urban environments. With their Container Kit project, complex building systems were divided into volumetric forms that protruded from the base container footprint, but could be pushed in to form a compact, transportable unit. The components contained different room functions – bathroom, kitchen, etc. In compact form, the building remains a standard container size'. The first example of The Container house can be seen at the Figure 7.

*Figure 7. The First example of container house, built by Mark Podlaseck and his partner, Steve Bryant (*http://www.lot-ek.com/MDU-Mobile-Dwelling-Unit*).*

This is a good example for modular structure and also it can be called the beginning of prefabrication. This MDU House project and its inventors were not aware that types of structural systems were going to be an inception of a new structural trend. Even though, container structural blocks are contemporarily being used for an urban site planning, shipping spaces, etc. After a while, Lot-Ek developed the MDU projects and started to use it as a building block. EK's Nine Level Shipping Container Mall in the New York City is a good example to follow the developments. Design sketches can be followed from Figure 8.

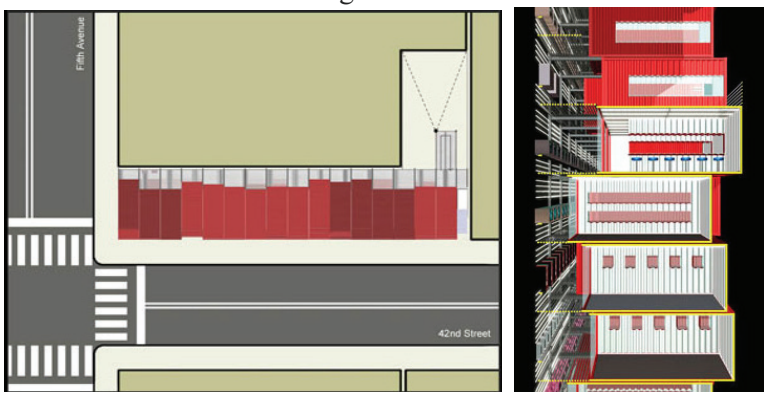

*Figure 8. Sketches of Shipping Container Mall site plan and section in New York (*https://inhabitat.com/lot-eks-nine-level-shipping-container-mall-for-new-york-city/lot-ek-shipping-container-mall-8/*).*

With the economy stalling, there are currently many empty lots or slivers of land sitting stagnant in the city. Shipping container malls could revitalize those unused spaces. Not only they are easier and, in many cases, cheaper to construct and uninstall than typical buildings, but also in the natural curiosity they breed in. People make them a great tourist attraction which in turn bolsters the economy.

In the 5th Avenue shipping container mall, each module would serve to house one shop. A system of catwalks, elevators and stairs would sit between the containers and an adjacent building creating a way for people to travel through the mall as well as outdoor space to enjoy. To break up the facade, containers are removed in some spaces so that air and daylight can permeate the mall. The example of the Nine Level Shipping Container Mall can be in Figure 9.

Figure 9. LOT-EK's Nine Level Shipping Container Mall for New York City (https://inhabitat.com/lot-eks-nine-level-shipping-container-mall-for-new-york-city/).

Considering the MDU House example, the main idea of the project was to implicate unoccupied shipping containers to a new design. Different from modular unit system, these containers were prefabricated. With the re-designing these containers according to the modular system strategies gained the main structure a hole modular notion. In this way, production process of the building was completed with modular discipline, and then the construction was completed considering the prefabricated consciousness.

The Term Terminal

The term terminal is a good interior partition solution for loft/ block spaces. For example, Terminal is the starting point in the spatial design process. It designed as a venue to guide the course of design journeys. Terminal presents spatial systems, unique products and solutions to meet the needs of commercial and cultural spaces, including offices, fair stands, shops and showrooms. With its dynamic design team to provide support, Terminal is a springboard for the spatial design process. New style containers, partitions, stands and vans can also use terminals to make spatial divisions.

-Partitions; (as an insider container.)

Terminal system presents flexible spaces capable of adapting to varying conditions. Open plan offices with flexible and uninterrupted structures are produced for lofts, industrial buildings or public spaces. The key is to develop the space so it can be used flexibly but still facilitate quality

communication. This aim guides every stage of the creative process from concept design to budgeting, planning and installation. The design achieves ergonomic results with high quality acoustics by means of spatial systems that are compatible and consistent. It can be seen as below in Figure 10. Terminal usage not just provide semi-open spaces, also creates one direction walls and partitions to divide two spaces from each other.

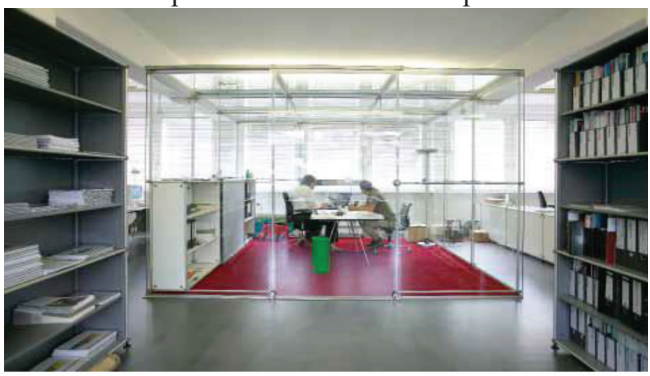

Figure 10. Meeting room divided from open plan offices with the system of terminal as partitions (http://www.terminaldesign.com.tr/*).*

- Stands and Exhibitions;

Stands and exhibition spaces are just a part of architectural aspect but, also for interior architecture, designing exhibition areas are good branches. In this survey is generally depends on architectural aspect of titles but, it needs to be mention stands in modularity title in general. Whether designed for two-stored high spaces or the smallest of areas, Terminal is fully equipped to produce stand and exhibition designs which have their own distinctive character.

The most flexible spatial solutions are achieved using a minimum of modules, enabling creative ideas to be put into practice with infinite variety. Sophisticated designs in which graphics and information find powerful expression reflect the aesthetic of austerity, so that a high standard is attained even in the smallest areas. It can be seen as below in Figure 11.

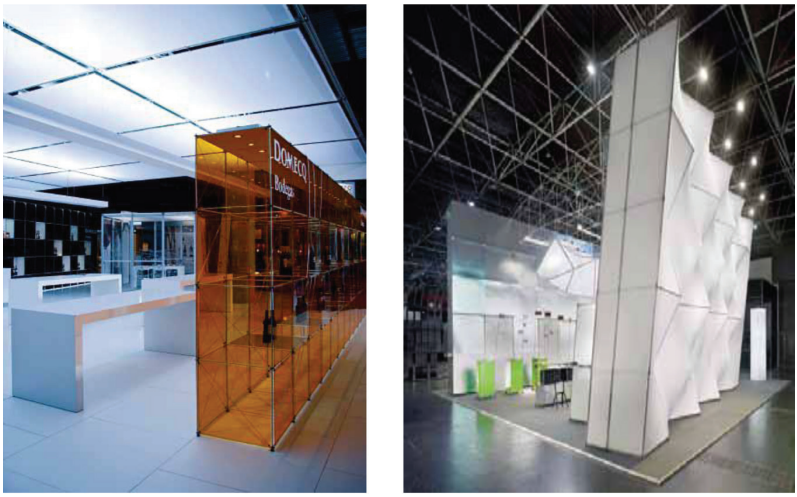

Figure 11. Exhibition stand examples built with the help of terminals as partition materials (http://www.terminaldesign.com.tr/*).*

Relatively for the term terminal example, partitions and stand/exhibition units are the good examples for the interior solutions of modular notions. With the contribution of modular systems being flexible and reproducible, it provides sustainable and adaptable approach in interior spaces.

CONCLUSION

Much academic work asserts a relationship between the design of a complex system and the manner in which this system evolves over time. In particular, designs which are modular in nature are argued to be more "evolvable," in that these designs facilitate making future and structure adaptations, the nature of which do not have to be specified in advance. In essence, modularity creates "option value" with respect to new and improved designs, which is particularly important when a system must meet uncertain future demands.

It is important for an architect to understand the limiting factors of the modularity and prefabrication that will affect the design procedures. The imposing of modular construction as a means of improving of off-site production (prefabrication) efficiency and worker safety in the construction industry raises into question the design quality of modular buildings, and whether or not the qualification of the building process can also be captured from the perspective of the manufacturer and the designer.

As it said before, modularity is a production system directly linked to the function and multiplication. By the way, prefabrication is an on-site technique and off-site production which reproduce architectural

constructions like building block ideas. After distinction of prefabrication complications, for understanding and differentiate of modularity development approaches also need to be known deeply. Traditional development approaches may prove insufficient when further integration between projects and products are needed. Eventually, modularity is a Structuring Principle for Systems which need to be apply correctly.

Design tasks in companies may change when modularity is introduced to users in an appropriate way. Furthermore, this research aims to impose the use and combine of the correct notions of the modularity and prefabrication in the design reuse, platform design and system architectures. This field deserves further exploration. With the combination of modularity and the prefabrication, construction techniques and detailed applications which applied to the buildings and site applications should be investigated in more detail.

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