Evaluating Flexibility Notions in Mass Housing of North Cyprus through Learning from Her Rural Vernacular Architecture

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ABSTRACT

One of the most important considerations in housing design is flexibility that refers to the idea of accommodating change over time. This concept is covered by the recent architecture, although it was used since the past times. In fact, flexibility is one of the most significant principles of traditional dwellings. Hence, it is also observed in rural vernacular architecture of North Cyprus as well. But it seems that, unlike vernacular architecture, flexibility is not considered as an axiom in recent architecture of North Cyprus especially in "build and sell" type of housing projects, which can be regarded as the subset of mass housing.

In this study, the main purpose is to evaluate notions of flexibility in recent "build and sell" type of housing projects of North Cyprus through learning from her rural vernacular architecture.

To achieve this aim, first the criteria for evaluating flexibility are going to be extracted through reviewing the literature. Then, notions of flexibility in rural vernacular architecture of North Cyprus are investigated based on the criteria, which were derived from the theoretical background. After that, particular case studies from recent "build and sell" type of housing projects of North Cyprus are going to be evaluated in terms of flexibility, to indicate if they have enough potential for flexibility or not; and if the houses can be adapted to various users and their changing needs and wishes. Finally, some recommendations are proposed for improving flexibility in recent "build and sell" type of housing projects of North Cyprus through applying notions of flexibility of her vernacular architecture.

The data collection method is based on observations in the forms of photographs, maps, AutoCAD drawings including; plans, sections, elevations and site plans as well as in situ observations and questionnaire surveys.

In general, this study attempts to improve flexibility in recent mass housing design in North Cyprus to provide long-term and short-term flexibility of housing through learning from her vernacular architecture, in order to give different users possibility of taking control of their living environments.

Keywords: flexibility, adaptability, rural vernacular architecture of North Cyprus recent architecture of North Cyprus, “build and sell” type of housing.

ÖZ

Konut tasarımında en önemli faktörlerden birisi değişen zaman içerisinde değişimi barındıran esnekliktir. Bu kavram önceki dönemlerden bu yana kullanılmasına rağmen, çağdaş mimarlık içinde yer alır. Aslında esneklik geleneksel konutların en önemli prensiplerindendir. Esneklik Kuzey Kıbrıs'ın kırsal Yöresel mimarisinde de gözlemlenir. Fakat yöresel mimarinin aksine, esneklik Kuzey Kıbrıs'ın çağdaş mimarisinde, özellikle toplu konut projelerinin alt grubu olan "yap-sat" türü konutlarda, bir aksiyom olarak düşünülmemektedir.

Bu çalışmada temel amaç, Kuzey Kıbrıs'ın yöresel mimarisinde esneklik nosyonlarını araştırmak; bundan çıkarımlar elde etmek; ve çağdaş "yap-sat" türü konut projelerine uygulamaktır.

Bu amaca ulaşabilmek için, öncelikle esnekliği değerlendirebilecek ölçütler literatür taramasından çıkarılacaktır. Sonra, Kuzey Kıbrıs'ın yöresel mimarisindeki esneklik nosyonu bir önceki bölümden elde edilen ölçütlere dayandırılarak incelenmektedir. Bundan sonra, Kuzey Kıbrıs'tan bazı çağdaş "yap-sat" konut projeleri, esnekliğe uygunlukları yeterince esneklik potansiyellerinin olup olmadığı; çeşitli kullanıcılara ve kullanıcıların değişen gereksinimlerine ve dileklerine adapte olabilmeleri açısından incelenmektedir. Son olarak, Kuzey Kıbrıs'ın çağdaş "yap-sat" konut projelerinde esnekliğe ulaşabilmek için, yöresel mimarinin esneklik kavramından faydalanmasını sağlayacak bazı öneriler sunulMaktadır.

Veri toplama yöntemi fotoğraflar, haritalar, Autocad gizimleri; planlar, kesitler, görünüşler, ve vaziyet planları yanında yerinde yapılan gözlemler ve anketlere dayanmaktadır.

Sonuç olarak, bu çalışma hem kısa hem uzun dönemde konut yapımının sürdürülebilirliğini sağlamak amacıyla, geleneksel mimariden dersler çikararak Kuzey Kıbrıs'ın günümüz toplu konut tasarımındaki esnekliği geliştirmeyi; ve bu sayede kullanıcılara kendi yaşamsal çevrelerinin kontrolünü ele alma olanağını vermeyi amaçlar.

Anahtar kelimeler: esneklik, adapte edilebilirlik, Kuzey Kıbrıs'ın yakın dönem mimarisi, Kuzey Kıbrıs'ın kırsal yöresel mimarisi, "yap-sat" türü konutlar.

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Chapter 1

INTRODUCTION

The concept of flexibility is an important concern in the design of housing. Flexibility refers to the idea of accommodating change over time. Thus, flexible housing corresponds to "housing that can adapt to the changing needs of users" (Till & Schneider, 2005). The concept of flexibility is covered by the recent architecture, although it is not a recent term, it has been used since the past times. Many dwellings, which were built in the traditional methods, have flexible characteristics such as multi-functionality, adaptability and variability.

In the past, people in both eastern and western societies shared the same dwelling commonly with their families; hence different generations of the same family inhabited and used the same houses. However, Industrial revolution and after it, the Second World War made significant changes in many social structures, including habitats. These changes also resulted in demographic transformation, accelerating technological evolution and new life style tendencies. So, these changes necessitate a new design paradigm in which, future dwellings need to be more adaptable to the dynamic nature of people's lives (Friedman, 2002).

Considering flexibility notions in housing design can give users ability to take control of their environment based on their changing needs and wishes. When existing dwellings meet the user requirements, they will not become functionally obsolete because of their flexibility which provides user satisfaction.

On the other hand, flexible housing can generally address issues of sustainability.

Providing environmental sustainability can be an important feature of flexible housing design. Flexible houses have multi-functional character and various functions can be accommodated in a limited space, they save energy and materials for housing construction. On the other hand, flexible houses are adapted to the household's changing needs and wishes due to the life style and market changes, and thus they have a long life span. These features provide environmental sustainability (Beissi, 2001).

As it was mentioned above, flexibility is one of the most important principles of traditional dwellings. Generally, most of the traditional dwellings are adaptable to climate, environment, and inhabitants' needs. According to Bektas (1996) one of the important features of traditional dwellings can be flexibility. It is possible to enlarge the dwellings unit by unit or divide them afterwards.

Alsac (1997) stated that one of the characteristics of traditional design is its general trend not to make distinctions between too many functions. This does not mean that every building was designed to be multi-functional but they were used in as many ways as possible. Houses, for example, were not only meant for living, they were also places of work and production. They provided shelter for domestic animals and farming was done in their immediate vicinity, in the gardens and fields adjacent to them. Even commercial activities were combined with it, a room converted into a shop served for trading functions.

According to various researches and publications (Turker, 2002; Dincyurek, 2002; Numan, Mallick & Dincyurek, 2003), flexibility and adaptability are also observed in rural vernacular architecture of North Cyprus as well. While it seems

that, unlike vernacular architecture, flexibility is not considered as an axiom in recent architecture of North Cyprus especially in “build and sell” type of housing projects which can be the subset of mass housing.

In fact, both increasing number of international universities and secondary housing tourism contribute to the variety of user profiles in North Cyprus, so it is expected that “build and sell” type of houses should be flexible enough for accommodation of various kinds of users from different cultures with different life styles while it seems that it is not considered in many cases.

In this respect, this study attempts to develop flexibility concept in recent mass housing design especially in “build and sell” type of housing projects in North Cyprus through learning from her rural vernacular architecture.

1.1. Aim

The main goal of this study is to evaluate notions of flexibility in recent “build and sell” type of housing projects which can be the subset of mass housing on the island through learning from her rural vernacular architecture.

This research has three main objectives: First, to investigate notions of flexibility in rural vernacular architecture of North Cyprus; second, to evaluate flexibility in particular case studies from recent “build and sell” housing projects of North Cyprus to find out if they are flexible enough or not; and finally to propose some recommendations for developing flexibility in the recent “build and sell” type of housing projects of North Cyprus through utilizing notions of flexibility of her vernacular architecture.

1.2. Organization and Methodology

This thesis is organized in five chapters. After introduction chapter that explains the aim, limitations and methodology of the study, in chapter two, a theoretical

background will be undertaken, by a literature review to build a framework for the study. The theoretical background includes three issues; various definitions of flexibility, importance of flexibility and different classifications of flexibility. Through reviewing the theoretical background, the criteria for evaluating flexibility in the case studies are extracted which are summarized in an evaluation table. Moreover, some successful flexible examples from contemporary architecture of the world will be explained in chapter two as well, to indicate that the flexibility concept was already achieved in contemporary world.

In chapter three, notions of flexibility in rural vernacular architecture of Northern Cyprus will be investigated according to the criteria, which were extracted from reviewing the literature.

In chapter four, nineteen projects from six different contractor companies, which design recent "build and sell" type of housing projects of North Cyprus, will be evaluated in terms of flexibility issues according to the criteria, which were derived from the second chapter.

Finally, in conclusion chapter, after summarizing the focal points, some recommendations will be proposed for flexible design in recent "build and sell" type of housing projects in North Cyprus for developing flexibility in mass housing of North Cyprus.

In fact, this study is a qualitative and quantitative analysis based on interpretation and observation of data. The methodology used in this research is divided into two parts: literature review and field study.

The second chapter, which is the theoretical part of this thesis, is based on a literature review. The literature is attained from books, articles, previous thesis and web sources.

In the third chapter, data collection method is based on existing articles, proceeding papers, theses and researches about rural vernacular architecture of North Cyprus as well as observations in the forms of maps, photographs, drawings, which include plans, sections, elevations, site plans.

In the fourth chapter, evaluation of nineteen projects is based on two methods.

First, evaluating flexibility criteria in the case studies from architectural point of view through analyzing the architectural drawings to find out if the selected dwellings have potential for long term flexibility or not. Data collection method is based on observations supported by photographing, Google Earth maps, and AutoCAD drawings of each project including plans, sections, elevations and site plans. The AutoCAD drawings are obtained from the companies who design the projects or from their websites on the internet.

Secondly, evaluating flexibility in 3 different stages of design, construction and usage stages in existing situation through questionnaire survey. The obtained data from questionnaires indicate how flexible the cases can be, in different stages as well as today's needs of the existing inhabitants in terms of flexibility. Three series of questionnaires are prepared for three different stages of design, construction and usage stages. The questionnaires, which are related to design and construction stage, are filled in by construction firms and the ones related to the usage stage are filled in by the existing inhabitants of the case studies.

1.3. Limitations of the Study

In this study, the focus is on flexibility issue in residential buildings.

In chapter two, successful flexible examples from contemporary architecture will be selected from the world architecture after 1920's, which are the years that notion of flexibility was accepted as a design principle in the world. The priority for

selecting the examples is that the examples comprise most of the notions of flexibility which were extracted from the theoretical section.

On the other hand, notions of flexibility are investigated in the rural vernacular architecture because the built form in urban areas changed continuously while rural house forms remained consistent under the permanent environmental factors (Dinçyürek, 2002., Pulhan, 1997). The notions will be derived from existing researches like articles, proceeding papers and theses which were completed already.

Since notions of flexibility are investigated in rural settlements so recent case studies are also selected far from urban areas for having a healthier evaluation. They are located within Famagusta and Iskele region (far from both Famagusta city and Iskele city) as a recent rural development area.

The cases, which are from 'build and sell' type of housing projects, were built by six well-known local construction companies (NorthernLand, Noyanlar, Halken, Dovec, Ilkay Genc, Levent Homes). These companies are some of the most active companies who are constructing this type of housing projects.

Although case studies are selected from different companies, they have similar characteristics. All dwellings are finished villas which are far from urban areas. The basic plan of the cases consists of open, semi-open and closed spaces like rural vernacular houses of North Cyprus. The reason of selecting case studies with such characteristics is that, general characteristics of the recent cases should be similar to the rural vernacular houses for having a healthier investigation.

Chapter 2

FLEXIBILITY in THE CONTEXT of HOUSING

In traditional architecture, dwellers designed and constructed their own houses. After that, architects got comprised in the design and construction processes and both the designer and the client exchanged their ideas with one another with no difficulty. Industrial revolution and the need to shelter many people in urban settings, caused a development in the multi unit housing type so in decision making process, the share of the builder or authority increased while the users who wanted to live in the houses were not part of their home-building process (Friedman, 2011).

Friedman (2011) also stated that:

> This change took place in the twentieth century as the western socio economic structure underwent transformation. The changes affected family structure, led to higher standards of living, and moved society into an era in which ongoing changes took place, and where more consumer goods were stored and used did not experience the same rapid evolution. Rather, it remained a static frame to a dynamic process(p.2).

These limitations resulted in unwanted moves, greater expenses for demanded internal changes and difficulty adapting to the physical constrains of the dwelling. (Friedman, 2011).

In this respect, flexibility is a means that is proposed to bring users back to active participation in housing and provide them with manageable tools to accommodate their ongoing spatial needs

The focus of this chapter is on flexibility and adaptability in recent architecture. Actually, the main purpose of this chapter is to present the conceptual framework of

the study through a comprehensive review of the theoretical background and finally an evolution chart will be extracted from the theoretical background.

In this respect, three issues will be investigated. In the first section of this chapter, various definitions of flexibility and adaptability from different authors will be surveyed to clarify the meanings. Then, importance of flexibility in housing design will be explored. And in the final section, different classifications of flexibility will be investigated.

2.1. Definitions of Flexibility and Adaptability

The English colloquial usage of the words "flexibility "and 'adaptability' are:

Flexibility:

1. Ability to change or be changed easily according to the situation (Cambridge English Dictionary Online, 2011)

2. The quality of bending easily without breaking (Oxford English Dictionary Online, 2011)

3. Able to be easily modified to respond to altered circumstances (Oxford English Dictionary Online, 2011)

Adaptability:

1. Ability or willing to change in order to suit different conditions situation (Cambridge English Dictionary Online, 2011)

2. Able to be modified for a new use or purpose (Oxford English Dictionary Online, 2011)

All of the mentioned definitions points to change and modifications according to the situation. Habraken (2008) mentioned briefly about the confusion in the terminology as; "flexibility and adaptability have multiple and often overlapping meanings that

make it virtually impossible to come up with a vocabulary accepted to everybody"(p.290) .

But in architectural discourse, different authors defined flexibility and adaptability in different ways.

Some of these definitions are collected in the following table in the next page.

Table 2.1.Chronological list of definitions of 'flexibility' and 'adaptability'

Authors	Year	Definition of Flexibility	Definition of Adaptability
Hooimeijer Priemus	remove 1969	A flexible house has the ability to differences between living situation and a customer's aspiration image (quoted in Hofland and Lans ,2005)	
Andrew Rabeneck, David Sheppard, Peter Town	1973	"Flexibility" is proposed against "tight-fit functionalism(p.698) Flexible housing should be capable of offering "choice" and "personalization" (p.698).	Adaptability in the housing context refers to housing units that can be "easily altered as circumstances changed" (p.699).
	1974	The concept of flexibility deals with the "constructional technique and services Distribution" (p.86).	Adaptability is related to the "planning and layout" of a building including the sizes of rooms and the relation between them (p.86)
Guy Oddie	1975		"The capacity of physical alteration by relocation, replacement and removal of components in respect to either the constructional elements or services of the buildings or by addition of further components towards increased adaptability."
John Habraken	1976	Possibility of having different layouts, changing the floor area, either by additional construction or by changing the boundaries of the units'.	
William Fawcett	1978	Flexibility as the uncertainty and changeability of the relationship between activities and spaces.	
Schroeder	1979	Flexibility means adaptation without changing building structure (quoted in Hofland & Lans,2005)	
. John Lang	1987	Flexibility refers to possibility of changing the structure for more accommodating different needs. Usually, it implies a change in the enclosing boundary and its internal structure. In a flexible space for instance, the walls between rooms are easily movable	

Authors	Year	Definition Of Flexibility	Definition Of Adaptability
Herman Hertzberger	1991	He introduced concept of "polyvalence". Polyvalence refers to "a form that can be put to different uses without having to undergo changes itself "(p.147)	
Steven Groák	1992	Flexibility points to "capability of different physical arrangements" (pp.15-17).	Adaptability points to "capability of different social uses" (pp.15-17).
Gerard Maccreanor	1998	Flexibility is a designed idea [that leads to] the collapse of the traditional layout" (p.40).	Adaptability is "a different way of viewing flexibility" which refers to Trans functionality and multi functionality(p.40) Maccreanor emphasizes that most adaptable buildings were those not originally planned for flexibility" (p.40).
Andrian Forty	2000	The confusion in meaning of flexibility" is based on two contradictory roles: "it has served to extend functionalism and so make it viable" and "it has been employed to resist functionalism." (p.148)	
Eli Stoa	2003		He focused on 3 aspects for defining adaptability. Generality: layout allows multifunctional use and accessibility without changes or rebuilding. Flexibility: layout of the building or area is adaptable through changes and rebuilding, Elasticity: extension and division of usable spaces through or without rebuilding.
Tatjana Schneider, Jeremy Till	2005b	Flexibility is based on issue of both social and technological adjustment to changing needs	adaptability is based around issues of use
	2007	Flexibility in the context of housing is "achieved by altering the physical fabric of building"(p.5)	Adaptability in the context of housing "is achieved through designing rooms or units so that they can be used in a variety of ways" (p.5). The ways that rooms are organized, the circulation patterns and the designation of rooms. It covers polyvalence.

The concept of flexibility and adaptability will be explained in more detail in the following paragraphs.

Rabeneck, Sheppard and Town (1974) explained Flexibility as a concept, which is related to permanent and fixed parts of the buildings that are the structural system and the service spaces. The organization of the rooms, their dimensions, the relation between the rooms and their functions are the concern for adaptability.

In 1992, Groák in his book entitled *The Idea of Building: Thought and Action in the Design and Production of Buildings* explained explains "adaptability" as capability of changes related to the internal space configurations in housing units. While "Flexibility" is defined as suitability for different physical arrangement, which is valid not only for interior but also for the exterior modifications of the unit itself. In this respect, it can be stated that Groák agrees with the definitions of Rabeneck, Sheppard and Town.

Schneider and Till (2007) further improved Groák's definition to clarify these concepts:

> While adaptability is achieved through designing rooms or units so that they can be used in a variety of ways, primarily through the ways that rooms are organized, the circulation patterns and the designation of rooms … flexibility, is achieved by altering the physical fabric of building: by joining together rooms or units, by extending them, or through sliding or folding walls and furniture (p.5)

According to the description above, adaptability seems to concern with the spatial organization of housing units in order to accommodate the change in use. Besides flexibility is not only related to changes in interior spaces and envelopes, but also to the structural changes and position of service spaces of the building. In this respect, flexibility includes both physical and social continuum in the housing. Thus, it can be asserted as including adaptability, as well.

Hertzberger (1991) in his book entitled *Lessons for Students in Architecture* defined “flexibility” in the housing context as the capability of proposing different solutions for diverse uses with no certain single solution but most appropriate solution.

He discussed flexibility in a different perspective by introducing the term “polyvalence”.

Maccreanor (1998) supported the argument of Hertzberger :

> Flexibility has for a long time been a subject of interest for architects. In the years to follow this resulted in many buildings with open, changeable planning around fixed service cores. One conclusion is that flexibility doesn't simply imply the necessity of endless change and breakdown of accepted formula. On the contrary, the buildings that have proven to be the most adaptable were those not originally planned for flexibility. (p. 40)

All above descriptions refers flexibility to capability of changing condition by altering the physical fabric of building. So, flexibility is related to both structural system and service spaces as well as the physical changes in the interior spaces. For example,in *Kallebäck* Experimental Housing ,the building provides opportunities to the users to make physical changes in both interior space and structure system in their houses over the time(fig.2.1)

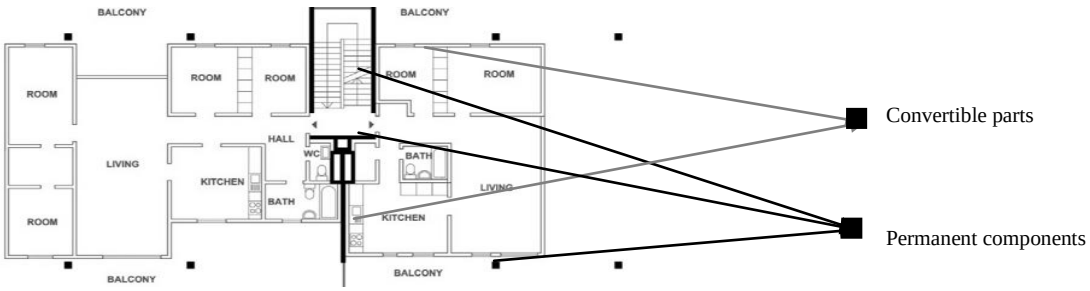


Fig 2.1: Flexibility deals with changing in both structural system and interior space by users: *Kallebäck* Experimental Housing (1960) by Erik Friberger in Sweden (adapted by Albostan, 2009; from Schneider & Till, 2007, p. 72)

Adaptability, on the other hand, is only related to the internal organization of housing units in order to accommodate the change in use such as organization of the

rooms, their dimensions, and the relation between the rooms without changing building structure. So, it can be stated that flexibility covers concept of adaptability as well.

For instance, Development Group of the MHLG in Britain designed an adaptable house in 1962 which allowed users to modify and adjust interior spaces of their houses according to their needs and wishes (fig.2.2).

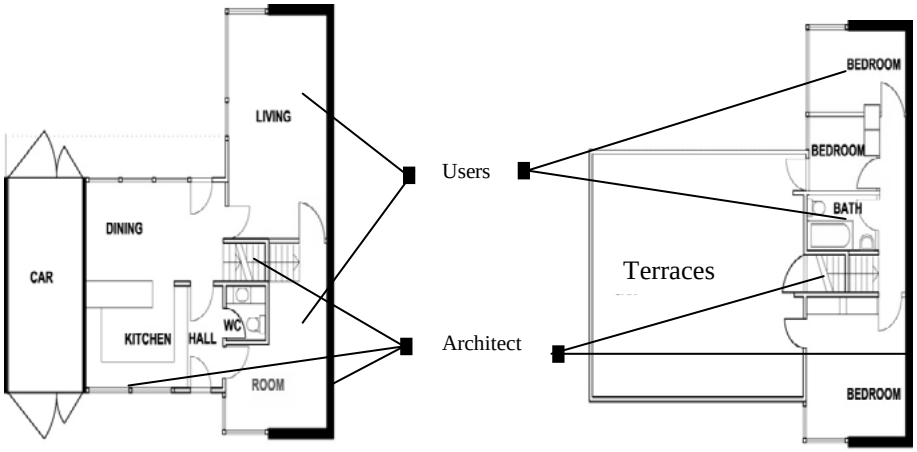


Fig 2.2. adaptability deals with changing in internal spaces: adaptable house (1962), by Development Group of the MHLG in (adapted by Albostan, 2009; from Schneider & Till, 2007, p. 73)

In contrast to the above definitions, a few authors such as Dluhosch (1974) and Schroede (1979) defined flexibility as the ability to change condition without changing building structure. In fact, they believed that flexibility is the ability to achieve change of conditions without changing the basic system.

Oddie (1975) defined adaptability as capacity of physical alteration in respect to either the constructional elements or services of the buildings or by addition of further components towards increased adaptability. In fact, Oddie (1975) believed that adaptability is an inclusive concept that covers flexibility as well.

To sum up, it can be stated that most of the mentioned authors considered flexibility as an inclusive concept covers the concepts of adaptability as well. Flexibility includes both physical and social continuum in exterior and interior parts of the building while adaptability seems to deal with the spatial organization of housing units without any structural alteration in order to accommodate the change in use.

2.2. Importance of Flexibility

After surveying various definitions of flexibility and adaptability from different authors and investigating different types of flexibility, in this part, importance of flexibility in housing design will be explored.

One of the most important features of flexible housing is that it allows users to take control of their environments during their occupation. It gives ability to the users to change their environment based on their changing wishes and demands over the time, so it can respond to their demands from the beginning of occupation and lasting over time. In fact, flexibility can provide user satisfaction since people don't have to move or pay more expenses for the changes needed (Schneider & Till, 2005a).

When existing dwellings meet the user requirements, the dwelling will not become obsolescent functionally. This is another feature of flexibility that can have positive effects on long term economic concerns (Bakkaloglu, 2006).

According to Till and Schneider (2005a):

> "Sense tells us that flexibility is more economic in the long term because obsolescence of housing stock is limited, but there is little quantitative data to substantiate this argument. However, all our qualitative research indicates that if technological systems, service strategies and spatial principles are employed, that enable the flexible use of a building, these buildings in turn will last longer, and they will be cheaper in the long run because they reduce the need and frequency for wholesale refurbishment" (p.162).

Affordability can also be achieved through flexible design. Freidman and Krawitz in the 'NEXT Home project' could achieve this aim through flexible design in 1996. Recently, the demand for a new housing alternative have increased because of the fundamental demographic and economic changes and The Next Home project that was designed and constructed at the McGill University School of Architecture, can be a respond to this demand by integrating flexibility with affordability. In this project, the users have the ability to select the interior components of their houses according to their individual lifestyles and budgets and can easily change these initial parameters as the need arises. On the other hand, it can be feasible to subdivide and rearrange the volumes both pre and post –occupancy to accommodate transformation from one housing type to another with minimal trouble and cost (Freidman and Krawitz, 1996).

Flexibility can be a way of providing privacy as well. in fact, flexibility increases the relationship of dweller with the dwelling so users can control their environment based on their needs and preferences. For instance, occupants can provide their desired privacy through changing the location of interior walls. (Shabani et al, 2000).

Actually, one of the most important advantages of flexible design is serving sustainability. According to Till and Schneider (2005) "Flexibility is an important consideration in the design of housing if it is to be socially, economically and environmentally viable" (p.1).

Beissi (2001) in his article entitled *flexible housing, compact city and environmental preservation: a critical look at Hong Kong experience* mentioned that adaptable houses are sustainable environmentally because;

> "First it accommodates various functional demands within a limited space so it saves energy and materials for housing construction. Second it is adaptable to requirement changes due to life style and market changes and thus it has a long life span. Third, since the technical modification is easier than conventional tight fit housing, the refurbishing, obsolescence and demolition require less material, energy and labor " (P.30).

According to Scheneider & Till (2005), if flexibility in housing is to achieve its full potential, it has to mean more than endless change without fixed determinants. This wider intent is examined by considering flexibility under issues of sustainability (P.6).

Kendall (2005) mentioned that most of the corporations, which are demanding the sustainable development; establish adaptable buildings with new construction techniques rather than the demolition.

The mentioned advantages are collected briefly in table 2.2.

Table 2.2. keywords showing the importance of flexibility

Importance of flexibility	
Motivating Participation	not only allows users to take control of their environments after occupation but also during the design stage
Satisfying the users	Users can change their environment according to their changing needs and demands over time
Avoiding functional obsolescence	When existing dwellings meet the user requirements so the dwellings will not become obsolescent functionally
Resolving over crowding	Flexibility can help to accommodate large families
Elongating Lifespan of the house	Possibility of changing the house according to the users' need and culture and as a result, increasing life span of the house. Helps increase the attractiveness, and therefore the lifespan of buildings as well.
Considering Finance	flexibility is more economic in the long term because obsolescence of housing stock is limited
Providing Affordability	Transformation with minimal cost
Providing privacy	Because flexibility increases the relationship of dweller with the dwelling so users can change their environment based on their need
Serving sustainability	

2.3. Classifications of Flexibility

The purpose of the next section is to explain different ideas and categorizations from different authors for better understanding of flexibility notion.

2.3.1. Processes of Flexibility

Time factor is a key factor in the classification of processes of flexibility (Bakkaloglu, 2008).

According to Oxman (1977), flexibility can take place in different stages during the life cycle of a building. These are design, construction and usage stages.
The first stage is design stage, where the designers utilize some strategies to promote pre- or post occupancy flexibility during the conception phase. The occupants' identity can be known or un- known during design process (Freidman, 2002). "Adapting the design to clients' needs prior to occupancy is harder when the identity of the occupants is unknown. It is a process that requires foresight and forecasting" (Freidman, 2002, pp.13). In fact, the future needs of the occupants are expected to foreseen by the architects and designers in this stage.

The second stage is construction stage. Freidman (2002) states that "Adaptability during construction stage refers to the employment of strategies that enable the builder or the occupant to make changes to the design as the project's building progresses" (p.13).

For instance, when the users are known they may change their minds about a space during the construction process. On the other hand, when the users are unknown the builder can offer some choices to the client such as choosing between alternative layouts for the same dwelling size.

The third stage is usage stage, when the users move into their houses and they may want to change it based on their needs, wishes, cultures and lifestyles. Besides, the users may change or the same users' changing needs.

2.3.2. Types of Flexibility

Beside various definitions, many authors categorize flexibility in different forms. These classifications that will be explained below are ways of understanding how flexibility can be obtained during design, construction and usage stages. In this section, some of the classifications will be investigated to clarify the conceptual framework of the study better.

Dittert (1982) which is quoted in Hofland & Lans (2005) classified flexibility into two groups: Functional flexibility and structural flexibility.

After that in 1990, Van Eldonk & Fassbinder added one group to the Ditteret's categorization. The three classifications are explained below in detail:

-Spatial (structural) flexibility: the ability to change the condition based on professional intervention.

This flexibility is not only related to structural changes but also to the physical alteration occurring in the interior space. Dwellers can change their houses according to their own preferences based on professional intervention. Although this spatial flexibility benefits the developer indirectly, it does provide freedom for the dwellers.

-Functional flexibility: the ability to change the condition without professional intervention. Dwellers can change the interior space of their houses based on changing their needs and wishes without structural alteration. It is based on assigning new functions in redundant rooms, changing the room function or the relation between the rooms

-Character flexibility: possibility of changing the façade or dwelling identity-aspects of architectural quality.

The similar classification was done by Al-Dakheel in 2004. But his classification was in more detail. Actually, Al-Dakheel determined some notions for each category to clarify them better. They are explained below in detail.

-Functional flexibility: the ability to control the residential spaces by modifying volumes, elements and furniture to the changing requirements of households.

Functional flexibility covers the following notions:

- Versatility: Layout permits spatial multi-use with minor structural modifications.
- Convertibility: Ability to convert one space from one function to another function permanently or the ability to exchange space functions with each other temporarily without any structural modifications.
- Ability to separate and rejoin units.
- Pre-design service and utility zones for plumbing and electric systems.

Gulaydin (2004) quoted in Bakkaloğlu (2006) also added one more notion to functional flexibility.

- Ability of rearranging the furniture in volumes

As one of the first functionally flexible examples, it can be pointed to the Maison Domino and Maison Citrohan from Le Corbusier.

According to Le Corbusier, the solution for the problems in housing could be solved by offering standardized solutions. From this point of view, he proposed a skeleton system called “Maison Dom-ino” in 1919 that can be regarded as one of the pioneering schemes for mass-produced housing constructions. This scheme consists of reinforce framework system with a broad flooring area. In fact, in this scheme the

permanent/fixed part is separated from the infill/unfixed elements and this free standing structure gives spaces the ability of free use and convertibility of spaces(Albostan, 2009) (fig.2.3).

Maison Citrohan, that was created by Le Corbusier in five versions between 1919 to 1927, is based on the Maison Dom-ino system. Actually, freedom of the space and free standing columns left the main area open and gives possibility of versatility and convertibility from one function to another function (Risselada, 1991) (fig.2.4).

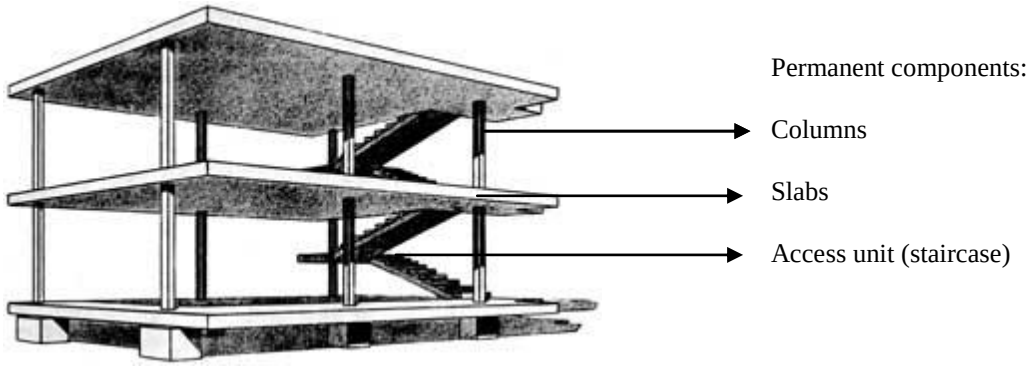


Figure 2.3: Maison Dom-ino by Le Corbusier in 1919

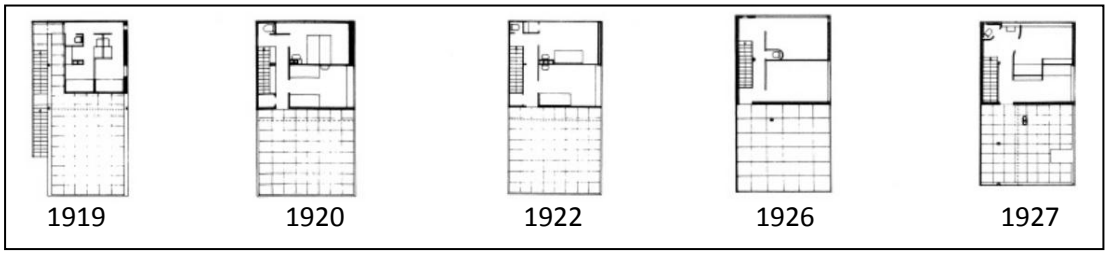


Fig 2.4. Five version of ground floor of Citrohan Houses (Risselada, 1991, p.95).

Schroder house which was designed by Gerrit Rietveld in 1924 can be a significant example of 1920's flexible house design. This house may be one of the buildings that have been created completely according to the De-Stijl principles. The fact that the house is both literally and figuratively open-ended is one of its most distinctive qualities and it provides a richer, more complex definition of what the architect and the client through modern living was all about. The main living area of the house is also an explanatory example of modularity. Rietveld designed a cabinet with

modular storage compartments for swing supplies, stationery, a phonograph and a movie projector (Friedmen, 1998, p.74).

The important features of this house are convertibility for changing space functions and ability of separating and rejoining of the volumes by using movable partitions. The basic requirements of the households as much as the privacy need can be obtained by the ability of conversion. The main living area has open plan and free structural system that gives ability of space changing (Bakkaloğlu, 2006) (fig.2.5)

Fig 2.5.functional flexibility in Schroder house (Friedman,1998, p.74).

As a successful functionally flexible example, it can be also pointed to the Dymaxion house which was designed by Richard Buckminster in 1929. It had a versatile and convertible character. It has a circular plan with steel-framed lightweight tower structure. The interior spaces included prefabricated movable partitions and the bathroom was similarly a prefabricated factory-produced unit (Jackson, 1996:32). Actually the movable walls give space the ability to convert the functions. It was also possible to separate and rejoin the room because of existing movable partitions. On the other hand, the ability of relocating wet spaces was a way

of achieving flexibility with independent spatial arrangement (Bakkaloğlu, 2006) (fig.2.6).

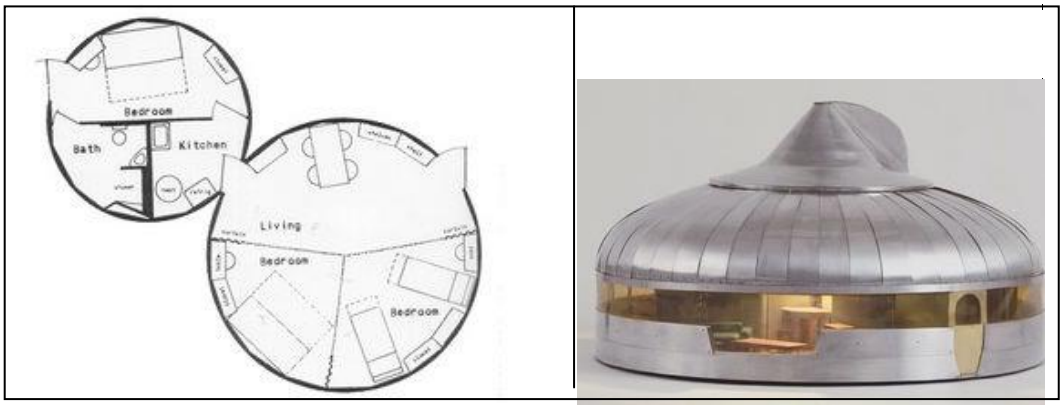


Fig 2.6.Functional flexibility in the Dymaxion house .

-Cultural flexibility: the ability to personalize the space.

It covers the following notions:

- personalizing the unit: Arranging the dwellings based on the users' taste and identity
- Improving exterior privacy: Privacy between public and semi-private areas.
- Improving interior privacy: Privacy between semi-public and private areas.

Robie house that was designed by Frank Lloyd Wright in 1909 can be a successful functionally and culturally flexible example.

This house is widely considered as a finest example of the Prairie style. The most important features of this style are: horizontal line, open floor plan and low-pitched roof. In fact, Wright wanted to reduce the rooms in a house to the barest essentials, have those spaces be free-flowing. This house with its fluid space between living room and dining room embodied his principles for an open plan (Elliott, 2002) (fig.2.7).

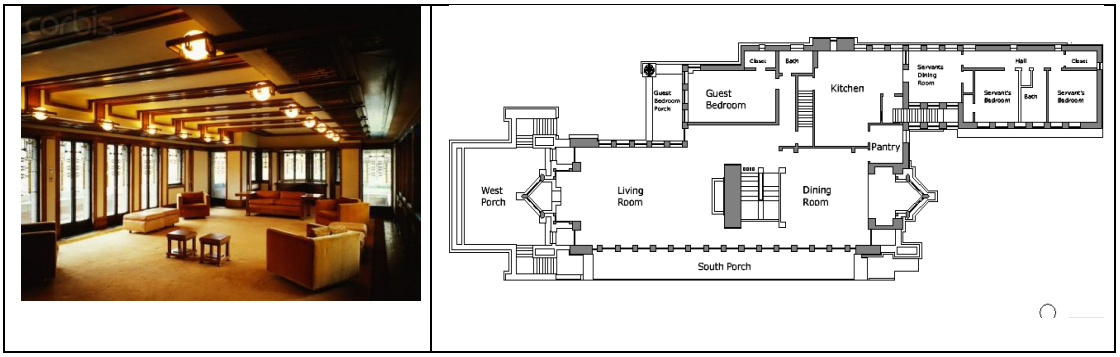


Fig 2.7.cultural flexibility in Robbie house

In fact, the open plan of the house gives ability to the users to convert function of spaces with each other as well as personalizing the units based on their needs and tastes.

The Jaffe house which was designed by Richard Rogers in 1966 can be a proper example of culturally flexible project.

Possibility of adapting the spaces into changing needs of a family was the demand of Jaffes. Sliding doors divided the living space into a public zone and a family zone centred on the kitchen. The private quarters are in the eastern edge of the house and the bedrooms can be relocated because of non structural walls (Powell, 1999).

The open plan of the house and non structural walls provide functional flexibility as well as cultural flexibility. Using non structural walls provides opportunity to the users to divide a room for different functions and also rejoin it for converting the room into single function. Therefore, the users can change their houses based on their own wishes, tastes and cultures. The open plan and non structural walls also provide an opportunity to improve interior privacy according to the wishes of the households as well (Bakkaloğlu, 2006) (fig.2.8).

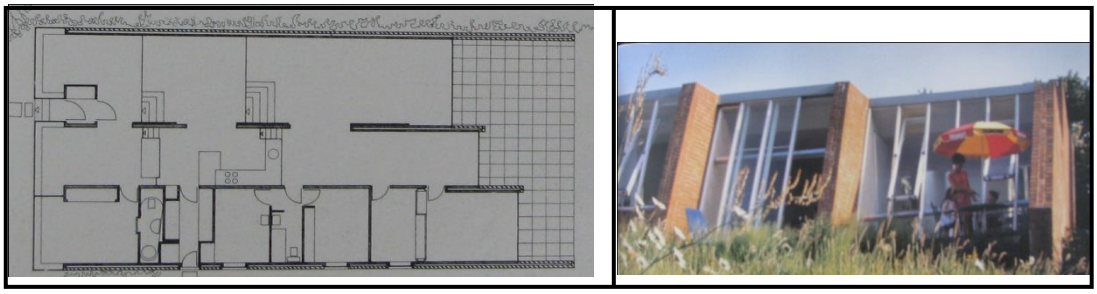


Fig 2.8. Cultural flexibility in Jaffe house (Powell, 1999, p.40).

-Structural flexibility: the ability to extend a unit vertically or horizontally and apply a system of standardized modularization.

It covers the following notions:

- Extendibility

Gulaydin (2004) that is quoted in Bakkaloğlu (2006) classified expansion into several views in housing context as below:

-Expansion according to direction; horizontal expansion, vertical expansion, horizontal and vertical expansion

-Expansion according to scale; expansion according to component scale, expansion in building scale, expansion in settlement scale.

-Expansion according to form; radial expansion, linear expansion and clustered expansion (Gulaydin, 2004:P.28)

"Add-on" and "add-in" method is another method for expansion in structural flexibility which was introduced by Freidman in 2002. He (2002) states that "design that considers expansion beyond the dwelling (add-on) or growth into a space within the perimeter of the original volume (add-in) is another form of flexibility and also adaptability" (p.17).

Schneider and Till (2007) in their books, *flexible housing*, introduced two main structural methods to attain flexibility: 'base structures" and "polyvalent organizations".

- Base structures (Open plan and free structural system)
- Polyvalent organizations (Standardized modularization)

Based structure covers the theory of support and infill systems, which were introduced by Habraken in 1972. It refers to a structural system that allows a layout that is not fixed in function. Actually, it accommodates the design idea of "incomplete or indeterminate buildings" by mainly focusing on the permanent elements, which can be listed as "structural elements", "access units" and "servicing".

This theory was developed into an approach that has generally become known as open building concept. The aim of this theory is regaining the natural relationship between dwellings and dwellers on the people who use the space (Beisi, 2001).

Supports are composed of fixed/common elements. The elements are column, girder, retaining wall, main mechanical systems ducts; vertical circulation core (stair and elevator) whereas Infill system consists of flexible elements determined for each single dwelling unit. These are partition walls, floor elements, doors, kitchen and bathroom equipments, all the conduits for electricity, heating, water and gas (Habraken, 2002).

According to till and Schneider (2005) this theory is probably the best-known constructional principle to facilitate flexibility in housing.

In the method of base structure, which covers the theory of support and infill, architects focus on support systems, which are permanent elements and they may intentionally leave the rest as a generic space for the users to fill in according to their needs and demands, as incomplete and indeterminate (fig.2.9).

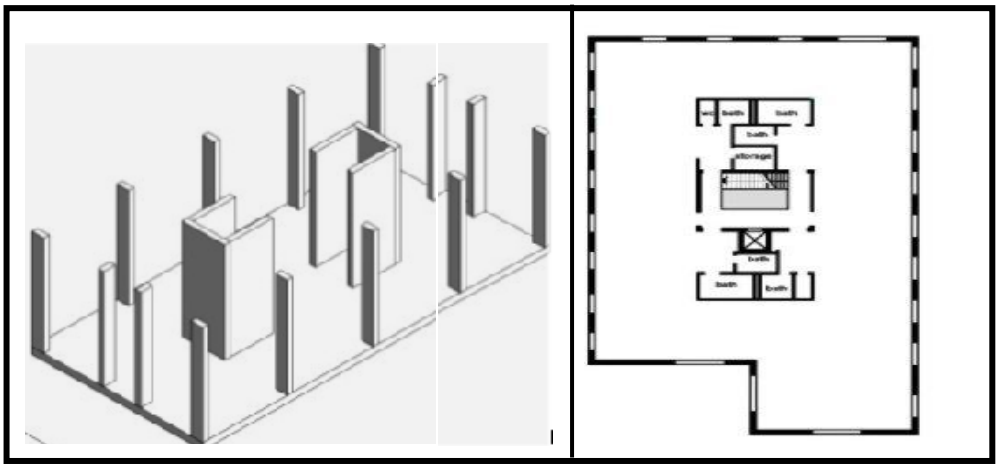


Fig 2.9. Incomplete or indeterminate building: focusing on permanent elements and leaving the rest for users to change it according to their wishes and needs. The Siedlung Hegianwandweg multi-storey apartment house in Switzerland (2003), by EM2N Architekten(adapted from Albostan,2009)

Polyvalent organizations type of structure is the second flexible structure, which covers the term polyvalence which was introduced by Hertzberger in 1991. Unlike indeterminate space idea of "base structures", the space in "polyvalent organizations" is generally divided into permanent "modules" with standardized dimensions, appropriate for diverse functions. In this approach, the sizes of the modules are standard and fixed in form, but it is possible to join two or more modules together or to divide a module into smaller modules (Albostan, 2009) (fig.2.10).

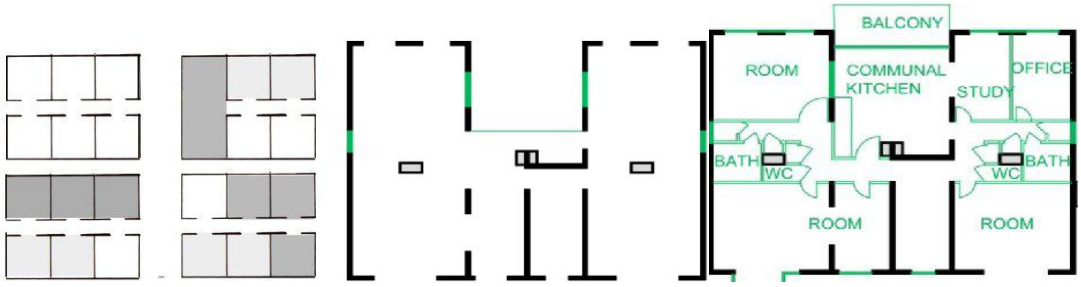


Fig 2.10. Polyvalent Organizations: Rooms without Labels: it covers the idea of modularity. The rooms are without labels, their dimensions are appropriate for different uses. The flexible Woningbouw multi-storey apartment house in Netherlands (1984), by Volkshuisvesting Rotterdam (Albostan, 2009).

After Al-Dakheel, Hofland (2005) set his own framework through various definitions and various kinds of flexibility. According to Hofland, there are different types of flexibility. These are:

1. Neutral for furnishing, (functional).
2. Possibility for change of floor plan, (structural).
3. Possibility to reshape apartments, (structural).
4. Modernization flexibility, (structural and functional).
5. Character flexibility (identity), (cultural).
6. Flexibility for changing safety requirements, (functional).
7. Wheel chair adaptability, (functional).
8. Capacity for expansion, (functional).
9. Multi functionality, (functional).
10. Finance flexibility, (functional).
11. Capacity to shrink, (functional).
12. Parking flexibility, (functional).
13. Robustness for calamities, (functional).

Many of these keywords were covered by above definitions and classifications. As an example, the first item refers to flexible furniture that Al-Dakheel who considered it in functional flexibility. Another item is capacity for expansion. Al-Dakheel (2004), Freidman (2002), Eldonk & Fassbinder (1990) pointed out to it in their definitions and classifications. In fact, Hofland (2005) tried to extract some keywords based on the various definitions to set his own framework.

Generally, based on the various classifications which were explained before, it can be concluded that flexibility can be categorized into 3 main groups; functional, cultural/character, and spatial/structural flexibility and each group can include some

notions, as well. On the other hand, different types of flexibility can be evaluated in 3 stages of design, construction and usage as well.

Zip Up Enclosures can be a significant example of flexible dwelling that includes all 3 types of flexibility as well. It was designed by Richard Rogers in 1971. The main aim of this project was to offer a wide range of choice to the users with a high degree of environmental control. The architect predicted potential purchasers going to their local home store to buy as many rings as they wanted or extra rings to enlarge an existing home according to their needs. Maximum flexibility for subdivision can be achieved because there is no internal structure in this project. Within the house, all partitions were movable so it can be possible to change the space functions according to users' needs and wishes. It was predicted that extra doors and windows could be provided by the householders (Powell, 1999: 82)

According to the mentioned descriptions, it could be possible to have a flexible dwelling with the characteristics of extendibility, division and multi-functionality. Because of movable partitions it can be possible to alter the space functions according to the wishes. It can also be feasible to have extension beyond the building when the population of the family increases and additional rings can be cancelled when it declines. These additional rings give the house versatility because of the structural modification during the addition process of the rings. The provision of extra doors and openings can provide exterior privacy as well as climatic needs of households (Bakkaloğlu, 2006) (fig.2.11)

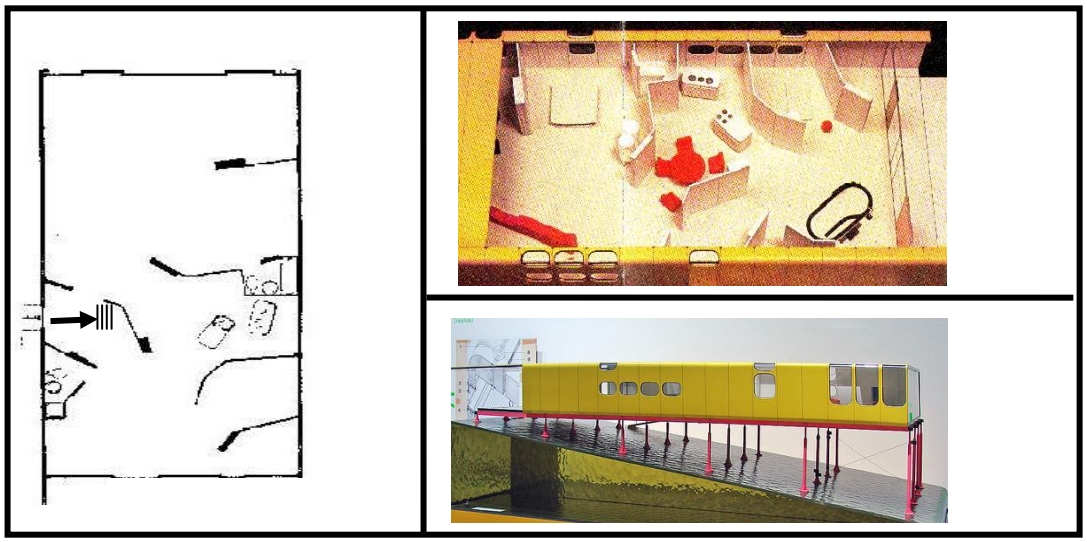


Fig 2.11. Zip Up Enclosures: a significant example of flexible dwelling

The following table shows different classifications of flexibility and the related notions of each category.

Table 2.3. different classifications of flexibility including sub-definitions

Functional flexibility	**Versatility**: spatial multi use with minor structural modification				
	Convertibility :	Ability to convert space from function to another without any structural modification			
		Ability to exchange or interchange space functions without any structural modifications			
	Multi-functionality: the ability of having different function at a same time, at the same place				
	the ability to separate and rejoin the rooms and units in terms of movable partitions				
	Flexible furniture: The ability to rearrange furniture				
	the ability to place wet spaces within specific zones but not to be permanently fixed, freedom of main space as generic space				
	Adaptable to climate				
	adaptable to disabled				
Character/ cultural flexibility	**Individuality:** change of condition, based on users preferences and their culture				
	providing privacy	exterior privacy: between semi public and semi private areas			
		Interior privacy: boundaries between semi private and private areas			
	cultural identity				
	adaptable to different users with different identities				
Spatial/ Structural flexibility	**Extendibility & Sub-division**	According to scale & dimension	component scale	horizontal	extension
					division
			building scale	Horizontal	Extension
					Division
				Vertical	Extension
					Division
		According to Form	radial expansion	Horizontal	
				Vertical	
			linear expansion	Horizontal	
				Vertical	
			clustered expansion	Horizontal	
				Vertical	
	Structural methods	indeterminate / incomplete buildings			
		standardized modularization			
	Form of roofs	possibility of vertical extension			
	Flexible façade	possibility of changing openings			

2.4. Chapter Conclusion

In this chapter, three issues were investigated for a better understanding of the flexibility concept; what flexibility is, why flexibility is important and how flexibility is classified.

It is clear that this concept is not a recent term and many researchers and architects considered it as a basic principle for housing design. Through reviewing the mentioned three issues, the flexibility criteria were extracted, which were summarized in table2.3. The criteria will be utilized for evaluating flexibility in the recent case studies as well as investigating flexibility in the rural vernacular architecture of North Cyprus.

To clarify the framework of this study more, it should be mentioned that in this study, the term flexibility is considered as an inclusive concept that covers adaptability as well. Flexibility is also classified into three main groups in this study: structural, functional and cultural flexibility and each group include some notions as well.

On the other hand, the house is divided into two sections; movable and non-movable sections. Non-movable components; consist of structure, skin and core (service space and access unit). Movable components; consist of space layout, furniture and users.

According to the theoretical part, Functional and cultural flexibility are more related to movable parts, while structural flexibility can be more related to non-movable components of the dwellings.

In the next chapter, rural vernacular architecture of North Cyprus will be investigated in terms of flexibility based on the criteria which were summarized in the table 2.3.

Chapter 3

FLEXIBILITY IN THE RURAL VERNACULAR ARCHITECTURE OF NORTH CYPRUS

There are number of names given to define certain built environments, namely, vernacular, anonymous, indigenous, folk, spontaneous and traditional (Oliver, 1997). In vernacular architecture, people formed their houses based on their traditions and needs. The houses were directly and un-self-consciously representations of their norms, values, images, lifestyle and other aspects of life. So, socio-cultural factors shape the main characteristics of vernacular houses and dwellings (Rapoport, 1969; Rapoport, 1982).

In addition to socio-cultural factors, natural environment also shaped the vernacular houses physically and functionally. They adapted to the geographical characteristics, topography ,climate of the region and available materials. Mercer (1975) mentions that products of the folk tradition belong to a type, which is common in a given area at a given time.

Builders of the traditional form were neither artists or designers, nor architects. They were the specialized craftsmen or owners of dwellings working within an idiom with variations within a framework, which can be adapted to social needs in various ways. The form of the house, even the materials to be used, is known by the builder and owner of the buildings. The same accepted form is applied with individual variability and differentiation. The model is adjusted according to specific requirements so it is additive, open-ended and generic. As mentioned by Rapoport

(1969) simplicity and direct solution to necessities and changes creates the basis of traditional houses.

This chapter includes a brief explanation about general characteristics of vernacular architecture of North Cyprus in both urban and rural areas. The main focus of this study is on rural areas because urban settlements were under the influence of several foreign powers and the imported lifestyles (Dinçyürek, Numan, & Pullhan, 2001). Therefore, the built form in urban areas changed continuously while rural house forms remained consistent under the permanent environmental factors (Pulhan, 1997; Dinçyürek, 2002). After the brief explanation, notions of flexibility in rural vernacular architecture of North Cyprus will be investigated according to the flexibility criteria.

3.1. Vernacular Architecture of North Cyprus

The island of Cyprus has a unique traditional built environment due to her multi cultural identity. Throughout the history of the island, many sovereignties existed emerging different ethnical groups, who have coexisted on Cyprus island. The vernacular architecture of the island could be investigated under two fields, which can be subjected as rural and urban settlements. As stated by Pulhan (1997) "although rural and urban settlements underwent diversified impacts of prevailing rulers, particular differentiation is traced in their architectural developments" (p.85). In fact, there are certain differences between rural and urban dwellings, although geographical, topographical, climatic parameters and availability of building materials generally signify the similar characteristics lifestyles (Dinçyürek, Numan, & Pullhan, 2001).

In fact, rural vernacular architecture of the island has been under influence of both agrarian ways of life and economical production (Dinçyürek, 1998) while

traditional urban forms of the island are mainly influenced from the prevailing cultures and the imported styles (Pulhan, 1997). For instance, people from different ethnical backgrounds lived in the capital city, Nicosia and gave the city a multicultural identity. Consequently, the built form in urban areas changes continuously opposing to the consistent development of the built form in rural settlements" (Pulhan, 1997; Dinçyürek, Numan & Pullhan, 2001).

In the following paragraphs, general characters of firstly the urban and then the rural vernacular architecture will be explained briefly. But, as it was mentioned before, the main focus of the study is on rural settlements so rural vernacular architecture will be investigated in more detail.

Christodoulos (2008) explained that:

> Nicosia, capital of Cyprus from as early as the Byzantine era, developed chiefly during the period of Frankish Rule, which could be described as its 'golden age'. During this time, the city acquired the structure of a western medieval city. When Nicosia passed into the hands of the Venetians and under the threat of the forthcoming Ottoman invasion, the structure of the city changed and it lost a large part of its medieval beauty and glory. After that, in 1570, Ottoman conquered the city. The organizations of the city changed as it was forced to adapt to the Islamic worldview, customs and way of life brought to it by the conquers. (p.7)

Ottoman period continued until the end of the 19th century and in the late nineteenth century, because of international impacts and westernization, the social structure, lifestyle and built environment of the city changed (Dinçyürek, Numan & Pullhan, 2001).

Generally, it can be said that the Ottoman Empire was one of the prevalent powers in the island. In this period, various cultures and religions emerged because of the multi-cultural nature of the empire. Pulhan mentions (1997) that the traditional Cyprus Turkish houses are one of the most identical architectural forms in urban areas as a reflection of this nature.

During Ottoman period, the basic ground plan of the houses consisted of four spatial elements which are closed, semi-closed, semi-open and open spaces. Combination of these spaces leads to various types of house plan organization. In fact, Turkish culture shaped spatial organization of the house. Family structure, gender roles in the family and society, their attitudes toward privacy, social intercourse and daily life of Turkish people determined organization of houses (Numan & Pulhan, 2001).

According to Pullhan (2002) the urban house plan type was classified into 2 main groups during Ottoman period (fig.3.1):

1. Plan type with outer hall- *Sündürme*

2. Plan type with inner hall-*Sofa*

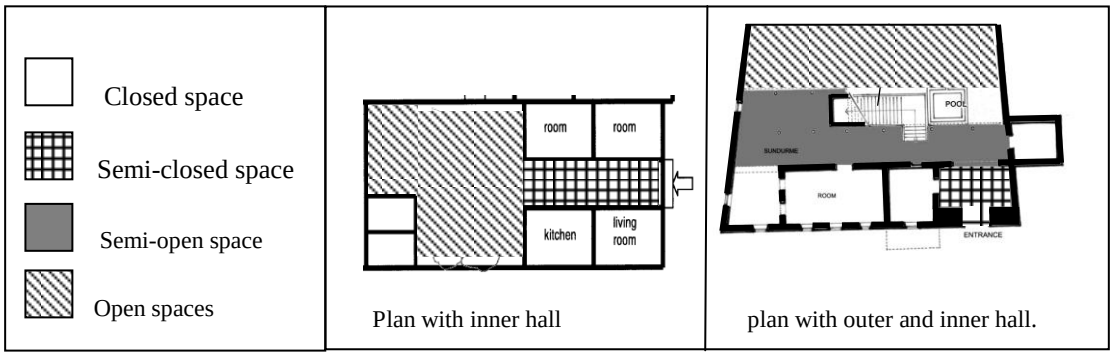


Fig 3.1.four spatial elements in the formation of house plans (adapted from Oktay, 2001 ; Pulhan & Numan, 2006)

Rooms, which are closed spaces, were utilized for more than one purpose. Multi-nucleated structure of the family required multi-purpose and self-sufficient living units (Pulhan, 1997). It has been commonly called, both in urban and rural areas, an 'ev', which means 'house' in the Turkish language because it was a multi functional space. The daily needs of the family were carried out in this space and when one or more rooms were needed, linear addition was observed in the houses (Numan & Pulhan, 2006).

As it was mentioned before, hall was divided into two categories in urban houses, outer hall and inner hall.

Outer Hall (*sündürme*) is a semi-open space, which is an intermediate and transition space between indoor and outdoor spaces of the house and between public-street and private family lives. It was a multi-functional space, which was located on walled garden side due to privacy and climatic conditions of the island (Pulhan, 1997; Dinçyürek, 1998; Numan & Pulhan, 2001; Turker, 2002; Erturk, S., Erturk, Z & Gunce, 2007).

According to Dinçyürek (2002), formation of the semi-open spaces on the first floors of the urban dwelling was the important plan organization, which was not found in the rural very often.

Inner hall is a semi-closed space, which is a transition space between indoor and outdoor spaces of the house as well. It is a multi-functional space like *sündürme* but in comparison to the outer hall, it is more enclosed and introverted.

Courtyard is an open space in urban houses, which is locally called *Havli* or *Avlu*. It is enclosed from all sides by the building mass and additional peripheral walls for achieving privacy from the outside. They were also located at the back of the building away from the street (Ateshin, 1997; Pulhan, 2008) (fig.3.2).

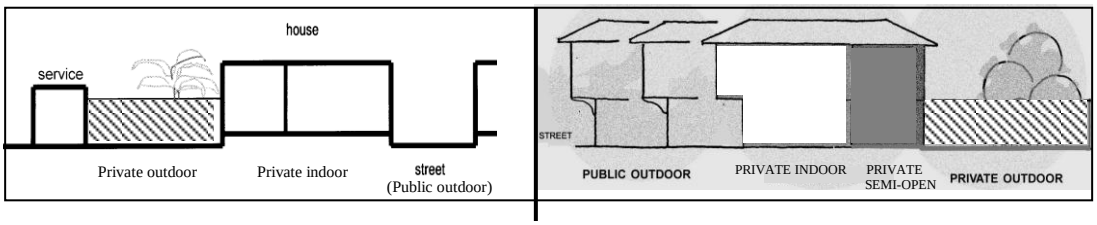


Fig 3.2.private courtyard at the back of the building (adapted from Oktay, 2001 and Pulhan, 2008)

The courtyards of the houses formed climatically comfortable spaces for the dwellers, and included diverse functions such as social gathering and entertainment for the afternoons and evenings. During the hot summer months, the courtyard traps

the dense, cool air in the center of the house, helping air circulation and decrease the general temperature inside (fig.2) (Oktay, 2001; Murat, 2001).

So open space in urban houses is a multi- functional space, which is completely adaptable to climatic condition as well. Generally, existing open, semi-open/semi-closed and closed spaces in traditional urban settlements allowed flexibility of use as the need or the climatic demands.

During Ottoman period, facades of urban houses could be divided into 2 parts: open facades and closed facades. Achieving privacy was an important factor in the formation of open and closed facades. Actually, adaptability can be observed in the facades. Facades were adapted to people's attitudes and beliefs toward privacy (Pulhan and Numan, 2005).

The open or extroverted courtyard (*havli*) façade, which includes the arcaded *sündürme* is utilized for circulation and meeting place for doing the daily works or welcoming the guests in the house. Within the boundaries of the enclosed courtyard (*havlı),* privacy was achieved for the inhabitants. In contrast to the open façade facing the courtyard, street façade of the traditional houses of Cyprus comparatively have less opening (Pulhan, 2008) (Fig 3.3).

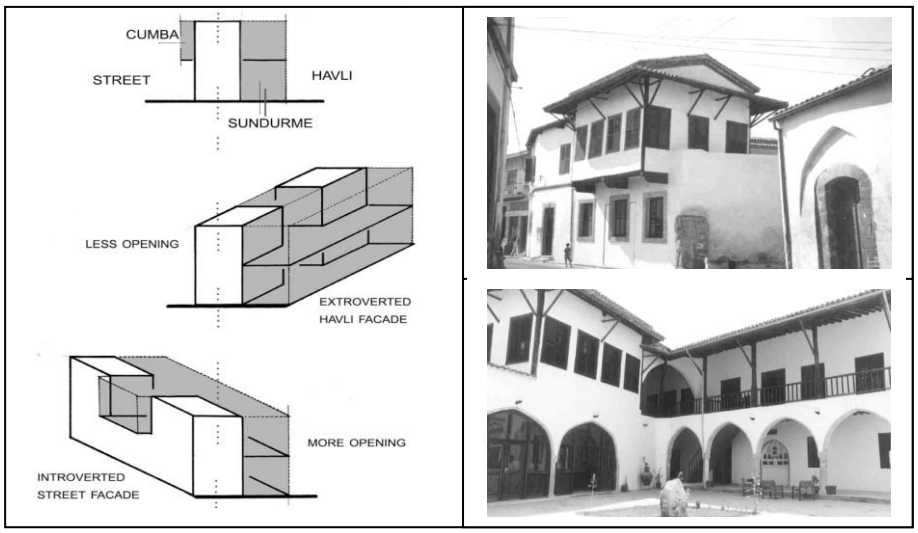


Fig 3.3.garden façade and street facade (Pulhan, 2008)

Ateshin (1997) also describes the residential architecture in the urban sectors of the island as:

> " In town, adobe and stone have always been used together in the vernacular buildings, adobe being plastered internally as well as externally. Street facing walls were mostly built in stone or had their windows and doors lined with a molded stone frame. In town houses, courtyards would be comparatively small and placed at the back of the building away from the street. Single and two-storey buildings would be roughly balanced with no apparent social reason. A regional hallmark in North Cyprus, as in Turkey, is the extension of the living space at the second floor level by a Cumba into the street; this usually had additional treatment in the form of cantilevered timber bracket beams and woodwork screens to provide privacy for the interior".

In brief, urban settlements started to become populated with the people migrating from rural to urban areas of the island at the turn of the 20th century and international influences became effective in the consistent of rural vernacular architecture of the island (Dinçyürek, 2002).

In the following section, characteristics of rural vernacular houses will be investigated in more detail.

Vernacular architecture is mainly expressed by the traditional houses of the island. For ages rural house form remained consistent under the permanent environmental factors of the island in contrast to urban form, which was under impacts of imported cultures and life styles (Pullhan, 1997; Numan, Dinçyürek & Pulhan, 2001). Actually, forms and shapes, sizes and dimensions, and also locations and orientations of the units were specially generated according to the answers to environmental, climatic, economic and socio-cultural aspects of the regions (Dinçyürek, 1998).

Rural settlements in the island were adapted to the morphology of the ground. In the mountains, the building density was higher than the plains in the villages (Georgiades, 1997).

In rural vernacular houses, the basic plan consisted of four spatial characters: closed, semi-closed, semi-open and open spaces like urban houses.

Closed spaces are rooms, which are multi-functional spaces. Mostly, the rooms can be seen in the ground level, however with the presence of the first floor in the dwellings rooms can be seen in both ground floor and first floor.

The courtyard as an open space, were used for daily activities as well as a play-groung for children. Actually, flexibility of use could be observed in the courtyard (Oktay, 2001; Numan & Dinçyürek, 2005).

Hall or *sündürme* is a semi-open space which is a transitional space between indoor and outdoor space. It has a multi-functional atmosphere as well as providing a comfort zone condition for inhabitants (Murat, 2001; Dinçyürek, 2002; Turker, 2002)

Mostly, the hall was generated on the north of the courtyard in the form of an arched (or post and beam) loggia between the yard and the house (fig.3.4) (Dincyurek & Turker, 2007).

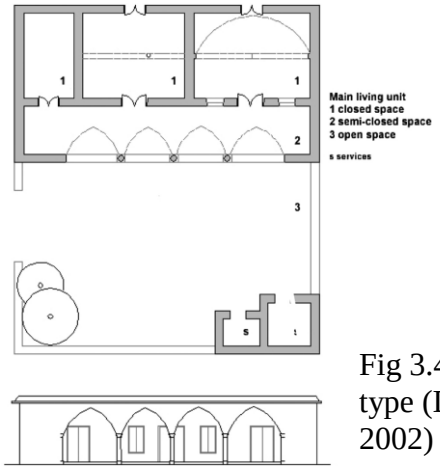


Fig 3.4. the most common Cypriot traditional rural house type (Dincyurek & Turker, 2007; adapted from Turker, 2002)

This provided shade to the habitable rooms in summer but allowed the penetration of sunshine in the winter. Habitable spaces were placed behind the loggia (fig.3.5) (Ateshin, 1997).

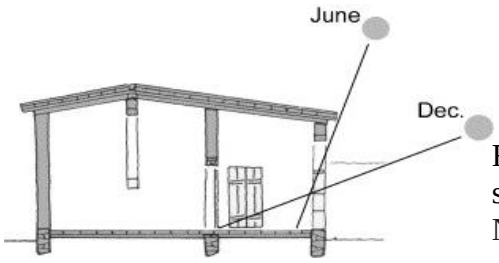


Fig 3.5. the position of shade during winter and summer in Sundurme (Dinçyürek, Mallick, Numan, 2003)

In general, the spaces in rural houses were oriented according to the direction of the sun and wind. Houses mostly faced south to take advantages of the sun. The arcades or the semi-open spaces are mostly located towards the south. The orientation of openings was arranged to get cross-ventilation according to the prevailing wind (Dinçyürek, 2002; Turker, 2002; Erturk, S., Erturk, Z & Gunce, 2007).

Generally, it can be stated that rural houses were adaptable to the climatic conditions, topography and other environmental aspects of the region to make sustainable use of natural resources.

As it was mentioned before, four spatial elements formed the living units of the rural houses, which are closed, semi-closed, semi-open and open spaces. These elements are combined to each other to form various types of plan organizations and this modularity also ensures the flexibility of the houses as well (fig.3.6).

Fig 3.6.four spatial elements in the rural vernacular houses

Dinçyürek in 2002 classified the vernacular rural house plan type of the island into three main groups (fig.3.7).

-single unit/units without hall

-those with outer hall

-those with inner hall

The classifications are based on the modular combination of the structure of the building

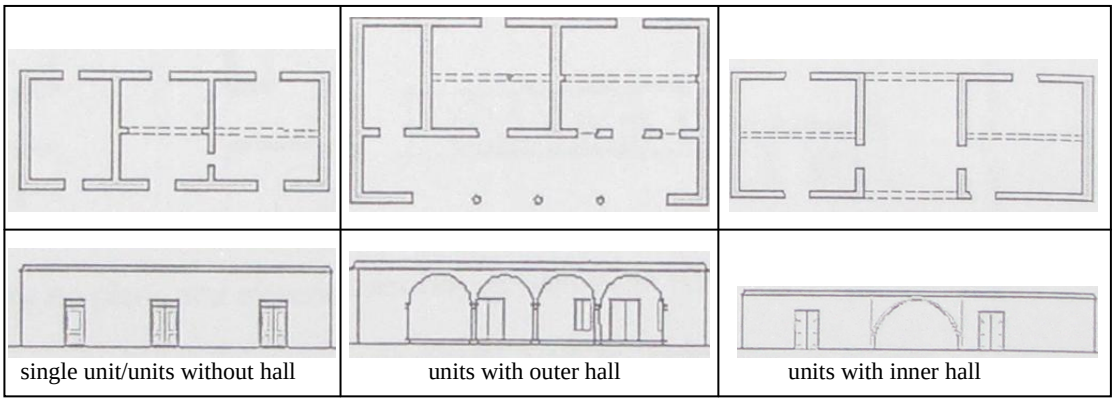


Fig 3.7.three main rural house plan types of the island (taken from Dincyurek and Turker, 2007)

Turker's classification (2002), which was parallel to Dincyurek's classification in North Cyprus was related to rural houses of Kaplica village as one of the villages of North Cyprus.

In the next section, flexibility will be investigated in the rural houses according to the criteria in the table.2.3.

3.2. Investigating Notions of Flexibility in the Rural Vernacular Architecture of North Cyprus

As it was mentioned before, vernacular architecture is mainly expressed by the rural house of the island so after describing general characters of vernacular architecture of North Cyprus, in this section, notions of flexibility in rural vernacular architecture will be investigated according to the types of flexibility, which were derived from the previous chapter.

3.2.1. Structural Flexibility in the Rural Vernacular Architecture of North Cyprus

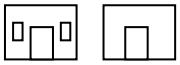
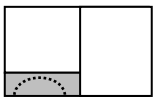
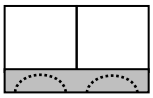
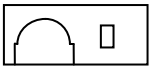
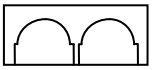
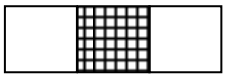
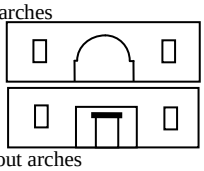
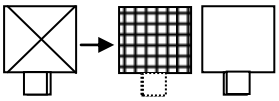
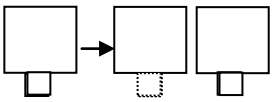
The construction system in rural vernacular houses is load bearing walls with timber roofs and the shape and dimension of the rooms depended largely on the length of available wooden beams and trusses. The average length of beams is around 6m (Demetriou et al, 2003; Numan, Mallick & Dinçyürek, 2003; Oktay, 2006) (fig.3.8).

Fig 3.8.Structural system; load bearing walls with timber roofs

On the other hand, as it was mentioned before, four spatial elements formed the living units of rural houses. These are closed, semi-closed, semi-open and open spaces and Combinations of them leaded to form various types of plan organizations.

In this study, rural house plan type is classified into four groups. This classification is based on the combination of Turker's and Dinçyürek's classification that was indicated before (table.3.1).

Table 3.1. Classification of main building units (M) in rural vernacular architecture of North Cyprus (adapted from Dinçyürek, 2002; Turker, 2002)

Group 1. single unit (S.U)			
Group 2. units with outer hall (U.O)		 	 
Group 3.units with inner hall (U.I)			Façade with arches  Façade without arches
Group 4.double Floor units (D.U)	with passage		Façade with arches 
	without passage		Façade without arches 

So, as it is indicated in table 3.1, main building units of rural houses were classified into 4 groups, which are S.U, U.O, U.I, and D.U. In addition to main building units, which consist of closed, semi-closed and semi-open spaces, the rural houses include other closed spaces such as service spaces and open space, which is courtyard/backyard.

Rural house = main building (S.U /+ U.O /+ U.I /+ D.U) + yard (courtyard +/ backyard) + service space. This is explained by Turker (2002) with a formula

U = M+C+S.

Today, this method of structure is known as ‘polyvalent organizations’, which is one of the main structural methods for achieving flexibility. This method was based

on the permanent modules with standardized dimensions which were appropriate for different functions. It was introduced by Hertzbeger in 1991 as a flexible structure.

So, the formation of the rural houses is based on the modular combination of the structure in the buildings (Dinçyürek, 2002). The modularity of the rural house ensures the flexibility as an answer to possible functional changes such as the family growth. Utilizing the modular flexible structure in vernacular architecture of North Cyprus also allowed for different types of expansion and division (Dinçyürek, 2002).

Horizontal extension in component/site scale could be observed during if enough land was available and due to modularity, it may not disturb form, or construction of the dwellings as well as unity and harmony in the facades. While, vertical extension is limited due to load bearing wall system, timber roofs and lack of access to technology, just possibility of adding one story to the house design stage (table.3.2).

For instance, it was possible to add one room next to the other room due to the inhabitants'needs for more functional spaces.

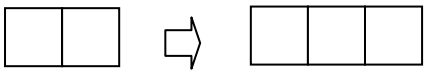
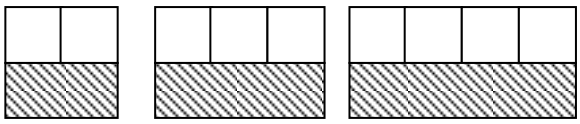
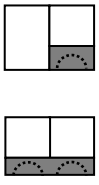
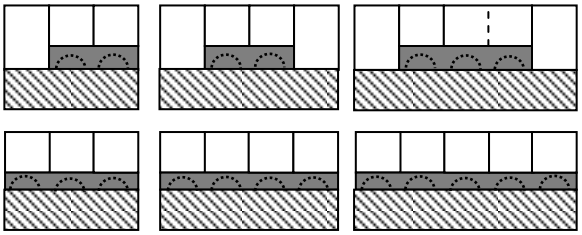
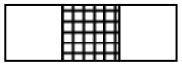
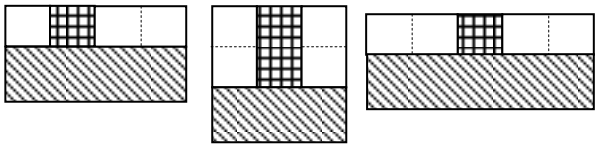
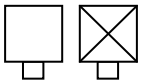


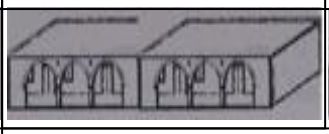
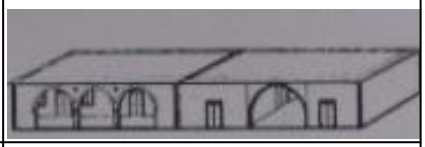
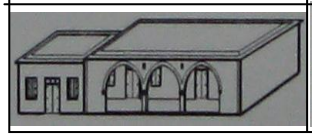
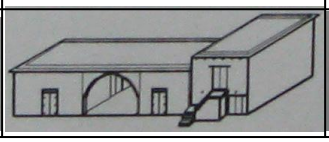
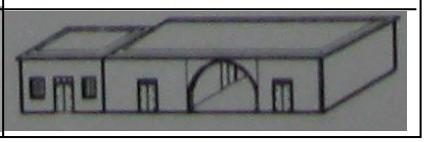
Table 3.2. horizontal addition in rural vernacular houses of North Cyprus(adapted from Dinçyürek, 2002; Turker, 2002)

single unit (S.U)		
units with outer hall (U.O)		

units with inner hall (U.I) 	
double floor units (D.U) 	Linear addition was not observed horizontally but it was vertical in component scale in this type of house

In Turker's study, addition as a way of transformation was observed in both typology and arrangements of archetypal units. The transformation of a single cell towards a rectangular main building unit by the addition of single square rooms is frequently observed as well as the addition of main building units into a complex domestic unit (U=M+C+S). In the following table, some samples of expansion in component/site scale is indicated (table.3.3) (Turker, 2002)

Table 3.3. Linear expansion in component/site scale (adapted from Turker, 2002)

S.U+S.U 	U.O+U.O 	U.I+U.I 
D.U+ D.U 	S.U+ D.U 	U.O+U.I 
S.U+ U.O 	U.I + D.U 	S.U+U.I 

It should be mentioned that the limitation in the dimension of local materials limited linear expansion. In fact, it was not possible to have a room with our ideal dimension and it was not also possible to extend the rooms or buildings as much as the users wanted due to limitation in the construction system. In other words, dimensions of the wooden beams limited the maximum space between load bearing

walls or arches (CCEAA, 2003, p.119). So, it can be said that various types of expansion could be observed in rural houses but with considering limitation in material dimension.

On the other hand, presence of modular coordination provides flexibility of the inside divisions for requirements. So, inner divisional variations between the opposite sides and between the ground floor and upper floor could be seen (Dinçyürek, 1998).

In fact, it was possible to observe the large space which is divided into a number of sub-spaces used as the main living spaces. The flexibility in the formation of spaces is formed as a result of structural and constructional modularity. For instance, the large space is usually separated by an arch or arches or post and beam in the mid points of the space, forming two or more sub-spaces. Level differences are sometimes used to determine these sub-spaces in the living units (Dinçyürek, 2002).

So, there are three tools for dividing a large space into a number of sub-spaces and each space can have various functions and this is completely adaptable to flexibility principles. However, in division process, this point should be considered that people in the past had no access to contemporary building elements such as movable partitions and sliding panels etc. So, divisions were done by using the mentioned tools or masonry materials and they were permanent and non-changeable. In other words, it was not possible to change or remove them during the time based on the users' changing needs and tastes and it is against principles of flexibility.

As a result, it can be said that horizontal division could be observed in rural houses and it is completely adaptable to principles of flexible design, but the dividing tools were permanent due to load bearing walls and using masonry materials and it is against flexibility principles.

In addition to linear expansion, rural houses of North Cyprus have the potential to expand as a cluster as well. For instance, if enough land was available, it would be possible to add one or several rooms and storages to the building according to the inhabitants' need (fig.3.9).

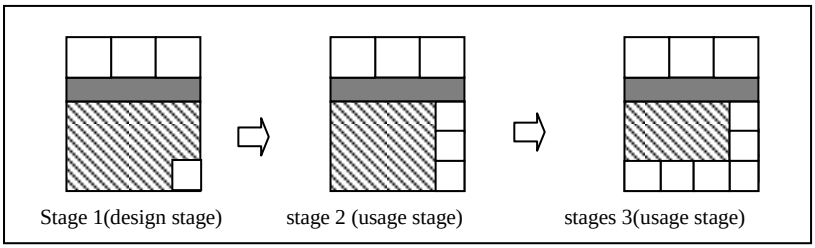


Fig 3.9. cluster expansion (adapted from Turker, 2002)

In fact, due to modularity Cluster and linear expansion in site scale could be feasible without disturbing the form or construction of the dwellings as well as harmony in the facades.

The modularity and plan organizations of the houses were also reflected to the facades directly.

According to Dinçyürek (1998) there are two modules in the formation of facades of rural houses.

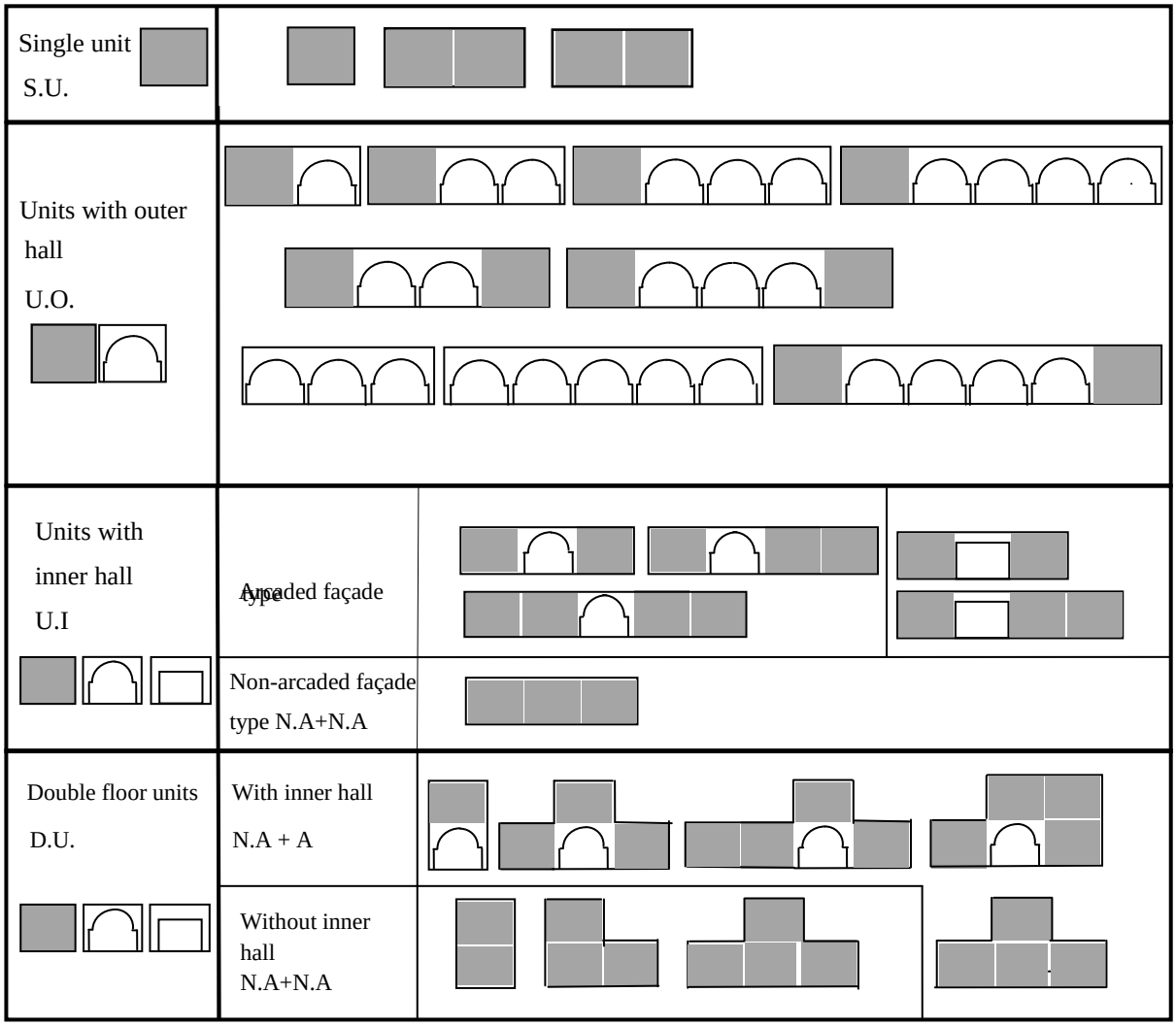
-Arcaded module (A)

-Non –arcaded module (N.A)

Actually, in different plan types of rural houses semi–open and semi-closed spaces transformed into arched façade module. In this way arcaded façades can be obtained where an arch meets with a module (Dinçyürek, 1998)

Combination of these two modules with themselves and with each other leaded to numerous façade variations in different house types (table 3.4).

Table 3.4. various formation of façade due to combination of N.A and N.A module (adapted from Dinçyürek, 2002)



So it can be stated that, flexibility could be observed in the formation of facades during design stage. While, it was not possible to change the façade during construction stage. On the other hand, the changes in the usage stage, e.g. closing the arcaded *sündürme*, changed the archetype completely.

In rural areas, forms of roofs were related to the region. In flat areas such as Mesaoria the roofs were flat, while in the mountainous areas, they were not (Dinçyürek, 2002) and this limited vertical expansion. In the following chart, summary of notions of structural flexibility are mentioned.

Table 3.5.Summery of Notions of Structural/Spatial Flexibility in Rural Vernacular

Non- Movable Parts; Structure, Skin & Core Spatial / Structural Flexibility	**extendibility and division**	According to Scale & direction	component / site scale	Horizontal	Extension	It could be possible if the land was available and no disturbance of the form, construction or unity and harmony in the facades due to modularity.
					Division	It could be possible due to modularity
			Building Scale	Horizontal	Extension	Due to modularity, possibility of adding one space next to the other space..While load bearing walls limited combining two rooms into a larger one.
					Division	It could be possible due to constructional modularity. On the other hand, the dividing tools were permanent due to load bearing walls and using masonry materials
				Vertical	Extension	It is limited due to load bearing walls and timber roofs
					Division	It could be restricted due to limited heights of the spaces
		according to form	Radial expansion	Horizontal	It is not considered in the evaluation because this type of expansion may not be possible in residential buildings	
				Vertical		
			Linear expansion	Horizontal	Due to modularity, possibility of horizontal extension if the land was available.	
				Vertical	Vertical extension is limited due to load bearing walls and timber roofs.	
			cluster expansion	Horizontal	Due to modularity, Possibility of having clustered expansion if enough land was available.	
				Vertical		
	Structural method	Incomplete/ indeterminate buildings:				
		Polyvalent organization: permanent “modules” with standard dimensions appropriate for diverse functions.		Various types of rural house organization due to Combination of the 4 spatial elements (close, semi-close, semi-open and open spaces) .dimension of the modules were suitable for diverse functions		
	Form of Roofs	Flexible (Flat roof) or Non-flexible		Most of rural houses have flat roofs. Using inclined roofs only in the mountains areas of the island		
	Flexible façade	Without hall		Modularity and plan organization reflected to the facades during design, no change during construction and usage stage		
		With inner hall		Closing the arches during usage stage was observed sometimes		
		With outer hall		Closing the arches during usage stage was observed sometimes		

As a result, according to table 3.5., it can be stated that structural flexibility was restricted in vernacular dwellings due to load bearing wall system, timber roofs and lack of access to technology. Although it was limited, modular structure ensures the flexibility as an answer to functional changes. Utilizing the modular structure also allowed for different types of expansion and division as well. Horizontal expansion and division could be observed in both building and component (site) scale due to modularity. While, vertical expansion was limited because of load bearing wall system and timber roofs. Vertical division in building scale was limited as well due to limited heights of the houses.

On the other hand, as it was mentioned before, façades are flexible during design stage but the possibility of changing the facades during construction and usage stage is limited.

3.2.2 Functional Flexibility in the Rural Vernacular Architecture of North Cyprus.

Rural vernacular houses of the island consisted of four spatial elements (open, semi-open, semi-closed and closed spaces) allowing flexibility of use as the need or the climate demands. Most of these spaces were used for different purposes.

Semi-open space which is called hall or *sündürme* is a transitional space between indoor space and outdoor space. Outer hall was utilized as multi-functional space, where resting, sleeping, hosting guests could be observed in it. It was located in a functional way in order to get appropriate ventilation and sunlight as well. Actually, it stimulates human comfort zone conditions (Dinçyürek, 2002; Turker, 2002; Erturk, S.,Erturk, Z & Gunce, 2007) (fig.3.10).

Inner hall is a semi-closed space which is a transition space between indoor and outdoor spaces of the house as well. It is a multi-functional space like *sündürme* but in comparison to outer hall, it is more enclosed (fig.3.11).

So, the halls (outer and inner halls) are multi functional spaces which are adapted to climatic conditions as well.

Fig 3.10.rural houses with outer hall (Author, 2011)

Fig 3.11.rural house with inner hall (Turker, 2002)

Mediterranean moderate climate and lifestyle, dictate the efficient uses of outdoor spaces as well. In addition to the usage of transitional space, open space as one of the important components of the domestic unit, was developed in the form of courtyard. The courtyard was utilized as children's playground as well as parent's space for doing their jobs; grapes, olives, tomatoes and carobs were cleaned and processed (Oktay, 2001; Dinçyürek & Turker, 2007), so it can be stated that it is a multi functional space where most daily activities took place in it.

Living space which is a closed space was utilized as a multi-purpose space for daily activities such as cooking, eating, and sleeping. Generally, living spaces occurred on the ground level. However, with the presence of the upper floors in the dwellings, it was possible to establish living spaces on the ground and/or first floor. Additionally, the family members preferred to stay at the first floor during the summer periods because of the cooler atmosphere and ground floor was utilized during the winter (Dinçyürek, 2002; Numan, Mallick & Dinçyürek, 2003; Oktay, 2006).

So, the rooms in vernacular houses were multi-functional and also had the ability to exchange their functions without any structural modifications during day and night or summer and winter. For instance, it could be possible to utilize the rooms for daily activities during the day and exchange its function during the night for sleeping.

Living space in vernacular houses of the island was usually a large single rectangular space in which most activities took place in it (Ateshin, 1997). It is possible to observe the large space which is divided into a number of sub-spaces by using some tools such as an arch or post and beam in the mid points of the space. Each of these sub-spaces could have various functions and they could exchange and convert their functions with each other as well (Dinçyürek, 2002) (fig.3.12).

For instance, the flexible spaces were used as bedrooms that include parts for parents and children, or a bedroom and living room, or a kitchen and storage area. Besides, the hearth was usually used for cooking and boiling facilities, it was also used for raising the temperature inside the living space especially in the cold winter times (Dinçyürek, 2002; Numan, Mallick & Dincyurek, 2003).

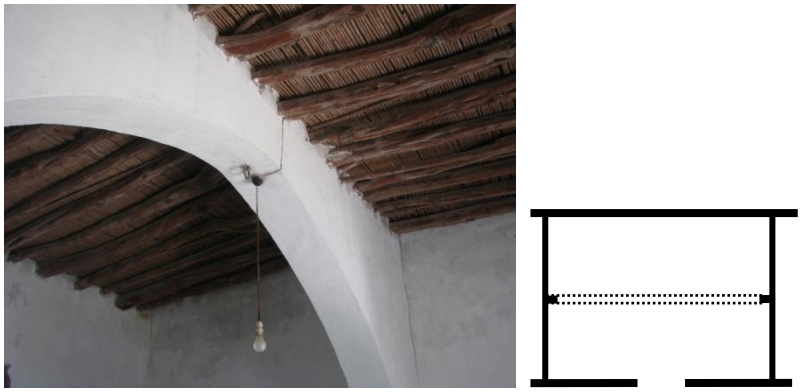


Fig 3.12. .Formation of sub-spaces in the main living spaces (Dincyurek, 2002).

It is observed that in some rural houses, people are still utilizing the living space as a multi-functional space (fig.3.13).

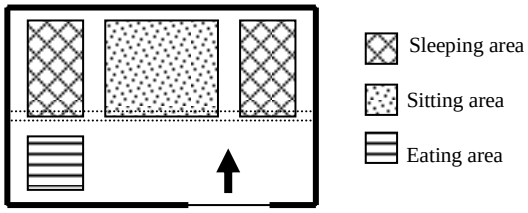


Fig 3.13.multi-functional spaces in vernacular architecture of North Cyprus

Because of structural and constructional modularity, flexibility could be observed in the formation of the spaces. But it should be considered that the dividing tools which were utilized in rural houses were permanent and it was not possible to remove them or change their locations according to the users' need and it is against flexibility principles.

On the other hand, using movable elements such as curtains for dividing the spaces into a number of sub- spaces was not observed in the rural houses of the island.

As a result, it can be said that multi-functionality and convertibility were the two important features of rural houses in North Cyprus while versatility was not observed in rural houses. In other words, it was not possible to have structural modification in the rooms for spatial multi-use while the rooms could have various functions and exchange and convert their functions with each other as well.

In rural houses, wet spaces were located in a specific zone and the rest were left as a generic space and these days, it is a proper method for achieving flexibility. In fact, when WC became useless and functionless, it was possible to rebuild it in another location in the same courtyard and users were free to construct it anywhere in the courtyard (fig.3.14).

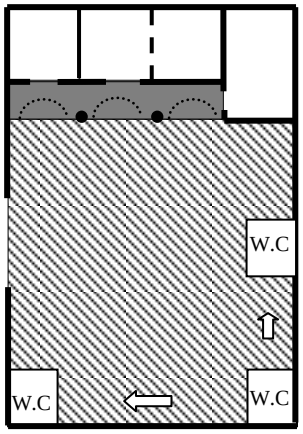


Fig 3.14. Locating the wet space in a specific zone and leaving the rest as a generic space
Possibility of reconstructing it in another location in the same courtyard

In living spaces of rural houses, the furniture was not fixed. They might have some fixed niches and shelves which are formed by gypsum or woodworks (Dincyurek, 2002; Turker, 2002). So users could rearrange the furniture based on their needs and tastes because the interior was left free from any constructional elements, so furniture could be arranged anywhere based on the users' need and users could change it again at a later time according to their need and culture.

As explained by many authors (Dincyurek, 2002; Turker, 2002; Dincyurek, Numan & Mallick, 2003), the houses are completely adaptable to climate. They were well oriented toward south direction to take advantages of the sun. Using open and semi-open spaces help air circulation as well as orienting the house toward wind direction. In the following chart, summary of notions of functional flexibility are mentioned briefly:

Table 3.6. Summary of Notions of functional flexibility in the rural vernacular

Movable Parts (Layout & furniture)	**Functional flexibility**	**Versatility**: spatial multi use with minor structural modification		It is limited due to load bearing wall system, timber roofs and lack of access to technology,
		Convertibility	Ability to convert space from one function to another without any structural modification	It is possible due to non-labeled spaces as well as the dimension of rooms was suitable for any function.
			Ability to exchange or interchange space functions without any structural modifications	Possibility of exchanging room's function due to nonlabeled spaces and dimension of rooms was suitable for any function
		Multi-functionality: the ability of having different function at the same time, at the same place		It is possible due to appropriate dimension of rooms and nonlabeled spaces
		the ability to separate and rejoin the rooms and units in terms of movable partitions		Because of load bearing wall system and lack of access to technology, no possibility of joining two rooms with each other and then separate them. Possibility of separating and rejoining the rooms by curtains, although it was not observed in most of the rural houses. The structural arch dictates the division of spaces.
		Flexible furniture: The ability to rearrange furniture		It is possible due to non-labeled spaces, non-fixed furniture, non-fixed cupboards. Dimension of the rooms were suitable for rearrangement of furniture leaving the interior free from any constructional elements
		the ability to place wet spaces within specific zones but not to be permanently ,fixed, freedom of main space as generic space		Locating WC in the courtyard and leaving the rest as a generic space. Possibility of rebuilding it in another location in the same courtyard
		Adaptable to climate		Using Local materials: using stone in mountain villages and adobe in the flat regions . Orientation towards the Sun: Houses mostly faced south to take advantages of the sun. providing natural ventilation: orientation towards direction of wind/cross ventilation . utilizing external Sun control devices: using semi-open and semi-closed spaces for providing thermal comfort.
		Adaptable to people with physical disabilities		In flat regions, there is not too much level difference in the dwellings. In mountain regions, ramp like topographic solutions at appropriate locations.

As a conclusion, it can be stated that in rural vernacular houses all spaces (open, semi-open, semi-closed and closed spaces) were adaptable to climatic conditions and the houses mostly faced towards south to control the effect of the sun.

Multi-functionality and convertibility were two important features of spaces in rural houses. While, versatility was not observed in rural houses due to load bearing walls, timber roofs and lack of access to technology.

Using movable elements such as curtains for dividing the spaces into a number of sub-spaces was not observed in the rural houses of the island, although it could be possible to use it. The dividing tools, which were utilized in the houses, were permanent so it was not possible to remove them or change their locations according to the users' need and it is against flexibility principles. On the other hand, the structural arch, which defined two sub-spaces in the room, dictates the division of the space into two

The users had the ability to rearrange the furniture because furniture was not fixed except the niches and shelves at the heights of the room which are formed by gypsum or woodworks. Actually, in the rural dwellings the interior was generally left free from any constructional elements, so furniture could be arranged anywhere based on the users' needs and tastes and users could change it at a later time according to their taste and culture.

3.2.3 Cultural Flexibility in the Rural Vernacular Architecture of North Cyprus

In addition to influence of the economic factors on form, shape and size of the units of the dwellings, socio-cultural factors are among the most important factors that defined the characteristics of vernacular dwellings on the island.

According to the culture of residents of the island, privacy was an important requirement for them.

Generally, in some of the rural houses there is no direct access from Public Street to private and indoor space. In fact, in many rural vernacular houses there was a hierarchy among spatial components of a domestic unit which is from the 'public exterior' to the private interior' for achieving privacy (Turker, 2002). Although, direct entrance to the transitional space (Sundurma) or to the closed space was observed in some dwellings as well (Dincyurek, 2002).

In rural dwellings, rooms can be classified as private spaces. The outer and inner halls, which were semi-open and semi-closed spaces, can be classified as semi-private spaces. They connected the rooms to the courtyard. The courtyard, which was an open space, can be classified as a semi-public space. And finally, streets are classified as public spaces and the dwellings generally have an opening facing the street. So the spatial relations ranging from public to private provided privacy for the residents (Turker, 2002) (fig.3.15).

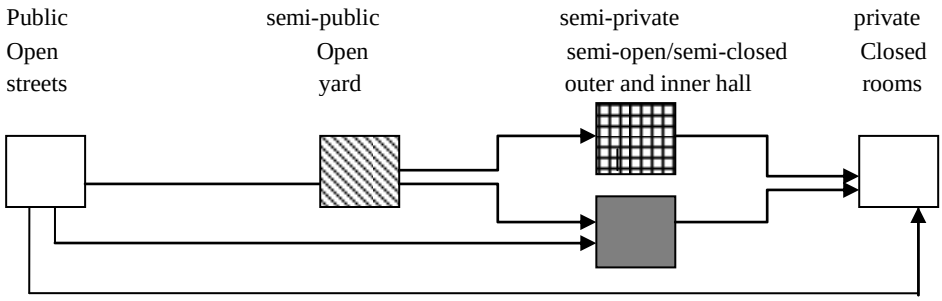


Fig 3.15. spatial relations ranging from public to private in rural vernacular houses

On the other hand, people in rural areas have their own memories, habits and lifestyles in their houses and their lifestyles played an important role in the formation of the dwellings. Actually, formation of open, semi-open/ semi-closed and closed

spaces with different functions, originated from socio-cultural and environmental factors in vernacular architecture of North Cyprus (Oktay& Orcunoglu, 2007).

For instance, residents of rural houses of the island have strong relations with their neighbors. Women in rural areas socialized with their neighbors inside their homes and these meetings also took place in *sündürme* which is shaded in summer and sunny in winters or, in the absence of a *sündürme,*the yard took over the role of the *sündürme*. So, formation of open and semi-open spaces were based on users' need for socializing, doing their daily activities and having better climatic conditions (Turker, 2002; Dincyurek & Turker, 2007; Gunce, Erturk, Z & Erturk, S, 2007).

According to an interview with the users of traditional houses in Ozankoy village, which was done by Oktay and Orcunoglu in 2007, the users were satisfied with their houses and did not want to move to recent houses which are more luxuries. The users said that they have good relations with their neighbours and have strong memories related with these houses. This proves that socializing and having close relations with relatives and neighbors is one of the important issues for inhabitants of rural areas. On the other hand, the agrarian life style together with climatic precautions were the main determinants of the house formation.

People in rural areas could change their conditions based on their needs and preferences. For instance, it could be possible to use the room for daily activities during the day and then replace its function with sleeping function during the night.

Users could also arrange the furniture of their houses according to their culture and taste because the interior was left free from any constructional elements, and furniture could be rearranged anywhere later based on the users' changing tastes.

The following chart summarizes the notions of cultural flexibility.

Table 3.7. Summary of Notions of Cultural Flexibility in Rural Vernacular Architecture

Cultural / character flexibility	**Individuality:** change of condition based on users preferences and their culture		It is possible due to non-Labeled spaces and appropriate dimension of spaces for various functions	
	providing privacy	exterior privacy: privacy for semi-private spaces (outer and inner hall)	Physical privacy	In many houses with outer and inner hall, yard could be a transitional space for providing physical privacy for semi-private spaces. In other words, in some cases there is no direct access from street to the halls
			Visual privacy	No legal limitation related to heights of the garden walls so the walls heights provide privacy for the outer and inner halls in many houses.
		Interior privacy: Privacy for private spaces	Physical privacy	In many rural houses, there is no direct access from street to the interior spaces due to existing yard or the halls (outer and inner halls)
			Visual privacy	Existing visual privacy Due to appropriate dimension of the openings as well as appropriate heights of the walls in many houses
	cultural identity		Adaptability to different cultural tastes due to Non-labeled spaces, dimension of the spaces is suitable for various functions, non-fixed furniture and non-fixed cupboards. Although, structural system may limit the openings	
	adaptable to different users		It is possible due to Non-labeled spaces, appropriate dimension of spaces for various functions, non-fixed furniture, non-fixed cupboards and leaving the interior free from constructional elements. So users can change their condition based on their cultural background, taste and needs	

3.3. Chapter Conclusion

The main aim of this chapter was to investigate notions of flexibility in rural vernacular architecture of North Cyprus to learn from it to apply in recent mass housing design in North Cyprus.

As it was mentioned before, vernacular architecture is mainly expressed by the rural house of the island. So, at the beginning of this chapter, general characteristics of rural vernacular architecture were explained. The formal characteristics of rural

houses can be interpreted mainly as; the modular combinations of cubic/prismatic forms; arcaded facades and semi-open/semi-closed spaces/transitional spaces; flat or slightly inclined roofs except in the central highlands of the island which are steeply inclined; awareness of topography; respectful relations amongst neighbors and defined private yards (Dincyurek & Turker, 2007)

After that, notions of flexibility were investigated in the rural houses according to table.2.3 and it can be concluded that vernacular dwellings had limited structural flexibility due to limited access to technology at that period, load bearing wall structure and timber roofs that restricted structural flexibility. Although, structural flexibility was limited; functional and cultural flexibility was provided due to modularity, appropriate space dimensions and the open system of courtyard as a potential for 'infill'.

Generally, it was recognized that the notions of flexibility in vernacular houses include:

-Modularity

- Multi-functionality

-Convertibility

- providing Individuality

-providing cultural identity

-providing privacy

-adaptability to climate

-adaptability to different users

-possibility of horizontal extension and division in both building and component/site scale

In the next chapter, particular case studies from recent “build and sell” type of housing projects in North Cyprus will be evaluated in terms of flexibility issues to indicate if these dwellings have potential for flexibility or not.

Chapter 4

Flexibility Issue in Recent "Build and Sell" Type of Housing Projects of North Cyprus

From historical periods to nowadays, requirements and wishes of households displays a great difference in the basis of social and economical conditions of their lifestyles. On the other side, users' expectations and needs can also change in time. Transformation in the family, which are getting married, having children, getting divorced, changing lifestyle are some of the changes in the lives of the users that need various space organizations. In fact, Household's requirements are different and dynamic; they become older; their habits and lifestyles change. For this reason, the use of space, change in the course of the time due to users' requirements jointly. So 'flexibility' concept in housing design can provide ample solutions to these changes in people's lives (Friedman, 2002).

According to the above statements, the purpose of this chapter is to evaluate flexibility in recent "build and sell" type of housing projects in North Cyprus, which can be the subset of mass housing, to indicate if they have potential for flexibility or not; and if the houses can be adapted to various users and their changing needs and wishes.

In this respect, firstly problems of recent mass housing in North Cyprus will be explained briefly. Then nineteen "build and sell" type of housing projects from six contractor companies are going to be evaluated in terms of flexibility issues according to the criteria which were derived from the second chapter.

The evaluation is based on two methods.

First, flexibility is going to be evaluated in the case studies from architectural point of view through analyzing the architectural drawings of the cases to find out if the selected dwellings have potential for long term flexibility or not. In other words, according to the definition of flexibility 'adaption to changing needs of users over time', do the houses have potential to be adapted to users' changing needs and wishes during the time or not.

Secondly, existing situations of the case studies are going to be evaluated in terms of flexibility in 3 different stages as design, construction and usage stages, through questionnaire survey. The obtained data from questionnaires indicate how flexible the cases can be in different stages as well as today's needs of the existing inhabitants in terms of flexibility (according to the flexibility criteria).

4.1. Problems of Recent Mass Housing in North Cyprus

Being between the Asia and Europe, the island of Cyprus is on the crossroads of trade and culture in the region so it has been under the influence of different various cultures with different civilizations. Each civilization influenced the architecture of the island with its own cultural and architectural values. In fact, they reflected their social and cultural background to their environment and architecture as well (Ozay, 1998; Orcunoglu, 2006; Hoşkara et al, 2009).

During the British period (1878-1960) a large number of people migrated from rural to urban areas and this has necessitated the large number of houses and consequently the first social mass housing units were implemented by British officials. The unique examples include: the row houses in Nicosia and Famagusta for peasants along with the CMC workers' housing in Lefke (Hoşkara et al, 2009; Orcunoglu, 2006).

From 1963 to 1974, many Turkish Cypriots were forced to leave their lands, villages, and homes in the southern part, and migrated either to live in small ghettos or in other countries (Sözen, 1998, 13). Thus, the Turkish-Cypriot administration developed a Refugee Housing project to upgrade the living conditions of at least some of the refugee families in 1965. Finally, in 1974 the island was divided into two parts and around 65000 Turkish Cypriots moved to the north of the island. Although some of them were settled into the abandoned houses of the Greek Cypriot who moved to the south, under such circumstances, the government was forced to intervene in the housing market by introducing the social housing law because of increasing demands for housing in 1978 (Hoşkara et al, 2009).

After 1983, there is an increase in construction sector because of establishment of the Turkish Republic of North Cyprus (TRNC) (Orcunoglu, 2006).

In 1986, social / mass housing was designed by the government and built in 1989 in three different stages in different parts of Northern Cyprus.

According to Hoşkara et al (2009):

> "In these social housing developments neither the spatial nor the social and cultural demands of households were considered during the design process. Social housing units have not to date met the household demands and spatial needs, which therefore led to the owners or tenants of these houses regularly carrying out their own alterations, both internally and externally in order to change the house based on their own needs at both cultural and spatial levels"(p.90).

Later, along with the expansion of the university sector in Northern Cyprus due to "the excessive demand for higher education in Turkey" (Yorucu and Keleş, 2007, 78), the housing demand has increased.

In 2002, a construction boom took place during the discussions on a re-unification plan called 'Annan Plan'. Kofi Annan, the general secretary of the United Nations prepared a plan to find a solution for the problem of Cyprus. The most significant

part of this plan was based on the problem of immovable possessions and exchange of them to the previous owners. Although the re-unification plan could not be applied since the Greek Cypriots did not accept it, the Annan Plan had a major impact on the construction sector (residential, commercial and industrial), as well as the property and housing market in Northern Cyprus. Actually, possibility of this matter, that the island would be European land, increased the popularity of the island all over the Europe (Türker & Pulhan, 2006; Dinçyürek & Türker, 2007; Hoşkara et al, 2009; Orcunoglu, 2006; Yorucu & Keleş, 2007).

In fact, foreigners from different countries started to come and buy land and property with reasonable prices, especially from the north part. Consequently, value of land increased and natives of the north part also started to sell their lands to construction firms and foreign people (Pulhan & Orcunoglu, 2005). According to Orcunoglu (2006), till the years of 2002 the application of foreign people to buy immovable possession, was around 1000; but between 2002 and 2005, this has incredibly increased to around 6000 applications (Pulhan & Orcunoglu, 2005). The main reason for the foreigners to choose the north part is reasonable prices of lands and properties compared to other European countries.

So, it is clear that the issue of housing development within North Cyprus over recent years has accelerated due to the emergence of the Annan Plan. Accordingly, massive and disorganized housing projects, which neither have neither an appropriate legal site-selection approach, nor any planning permission have appeared in various locations throughout the island. As a result, this approach has generated a fragmental growth in housing environments that has led to unconscious use of land and environmental resources.

Actually, during the process of housing construction, there is no doubt that the user profile and market policies in respect of housing supply have not been well defined. Land is consumed very quickly and unconsciously (even much faster than the growth in population), which in turn leads to the unsustainable use of resources and this issue is emerging as one of the most problematic issues in many urban regions in Northern Cyprus, such as Girne, Lefkoşa, and Gazimağusa as well as rural areas of Girne coastline and Salamis coastline (Hoşkara et al, 2009).

As it was mentioned before, all these new housing types and developments have been constructed in a rapid and unplanned manner without considering both social and cultural demands of the users who want to live in these houses and the environmental conditions such as topography, natural resources and climate. It is clear that the houses are 'copied' and 'pasted', everywhere without demonstrating any thought or consideration for the existing environmental context (Hoşkara et al, 2009).

According to a research which was done by Keleş (1998), the recent buildings in North Cyprus were built unconsciously from the climatic design point of view. Starting from site selection, in every step of design many incorrect decisions had been taken.

A similar research was done by Tursoy in 2006. He stated that vernacular houses are in harmony with the environment, besides being environmentally sustainable. While, last period mass housing has not been carrying any feature in the context of environmental sustainability. Especially, in the last year's rapid developments, there is no sensitive formation towards environment in housing developments and this cause destruction to environment in non returnable way (Tursoy, 2006).

On the other hand, the development of mass housing is under the impact of rapid socio-economic and technical transformations and social and cultural demands of the occupants were not considered during design process. So, the occupants were forced to change their houses based on their own needs during usage stage. The changes were sometimes time and cost consuming or sometimes they could not change the house because of structural and functional limitations so they were forced to move to a newer house. (Pulhan& Orcunoglu, 2005)

According to the above statements, it can be mentioned that lack of adaptability to environmental conditions and socio-cultural demands of households can be observed in recent mass housing of North Cyprus while flexibility and adaptability are significant characteristics of vernacular houses of North Cyprus as it was investigated in the third chapter.

So, in the following sections, it is going to be more focused on flexibility issue in nineteen recent 'build and sell' type of housing projects from Iskele - Famagusta region, to find out their flexibility levels.

4.2. Evaluating Flexibility in Recent Mass Housing of North Cyprus from Architectural Point of view: "build and sell" type of housing projects from Iskele - Famagusta region as a case study

The main purpose of this section is to investigate flexibility in nineteen case studies from six companies through analyzing their architectural drawings to find out if they have potential to be adapted to various users and also their changing needs and wishes over the time. The cases were selected from the "build and sell" type of housing projects by six well-known construction companies. They were built around

Iskele - Famagusta region as a recent rural development area. In fact, the case studies are far from urban areas, both from Famagusta city and Iskele town.

Although, the cases were selected from six different well-known local construction firms (Dovec, Halken, Ilkay Genc, Levent Homes, Noyanlar, Northernland), the nineteen case studies have similar characteristics. All projects are finihed villas, which are far from urban areas. The basic plan of the cases consists of open, semi-open and closed spaces like rural vernacular houses of North Cyprus.

Table 4.1. General information about all projects.

No of projects	Name of company	Name of projects	Type of houses		location
P.1	Dovec	Dovec project	33 detached villa, 3 types	A B C	Boğaz-Iskele
P.2	Halken	Mutluyaka houses	40 detached villas, 3 types	A B C	Famagusta-Mutluyaka
P.3	İlkay Genç Group	Unique Salamis Villas	21 detached villas, 3 types 10 semi-detached villas, 1 type	A B C	Salamis-Famagusta
P.4	Levent Homes Group	Boğaz Cove Villa	31 detached villas, 2 types	1 2	Iskele
P.5	Noyanlar	Ötüken site 6	22 detached villas, 6 types	A B C D E F	between Salamis Bay and Long Beach(Salamis-Famagusta)
P.6	Northernland	Pearl village	66 detached villa, 2 types	Silver golden	Bahceler (Boğaz -Iskele)

In the following tables, general information about each project will be explained briefly.

Table 4.2. General information about Ötüken site 6

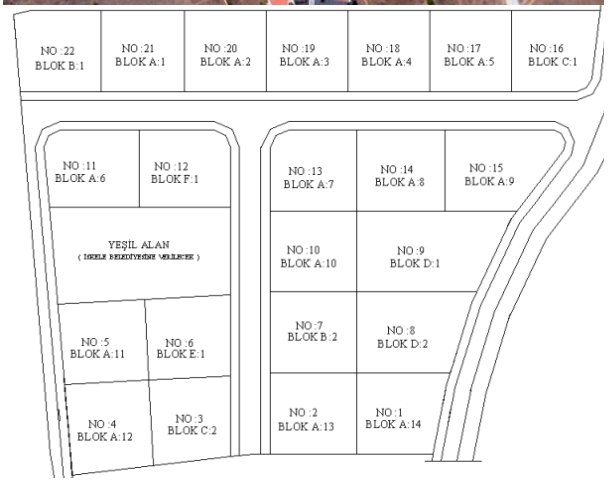
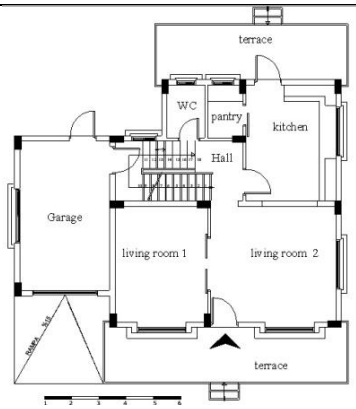
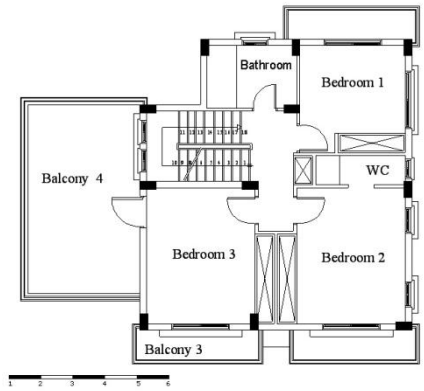
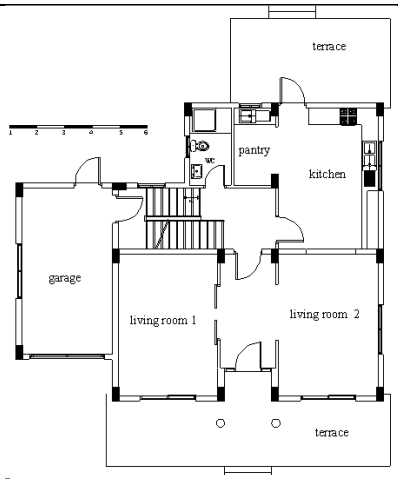
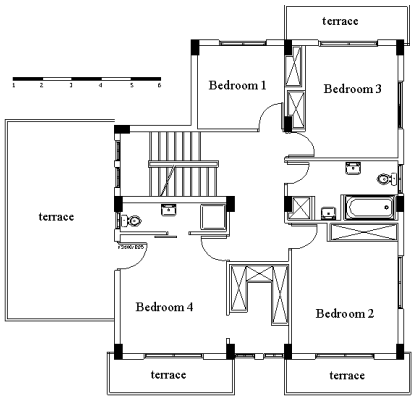
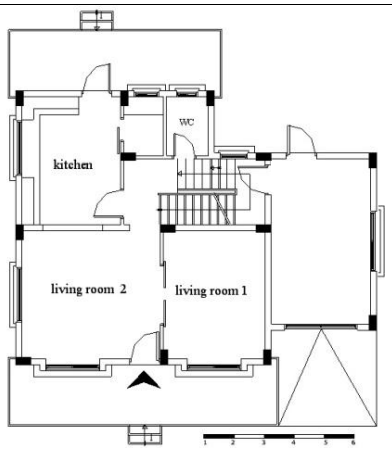
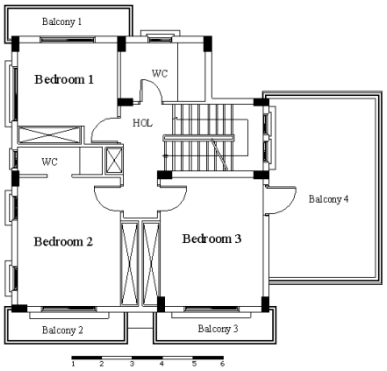
General information	**Ötüken site 6**	**Site plan**
Construction firm	Noyanlar group	
Location	between salamis bay and long beach	
General information	This project consist of 22 detached houses which are in 6 types of A, B, C, D, E, F. they are different in size and plan organization	
Construction methd	Reinforce concrete and brick walls	
Notions of flexibility are going to be evaluated in all 6 types.		

Table 4.3. Plans of type A, B, C, D, E, F houses in Ötüken project

Plan types	Ground floor plans	First floor plans
Plan type A closed area: 254.4m²		
Plan type B Closed area: 327.7 m²		
Plan type C closed area: 254.4 m²		

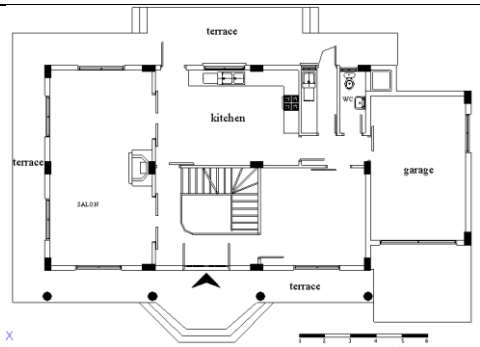
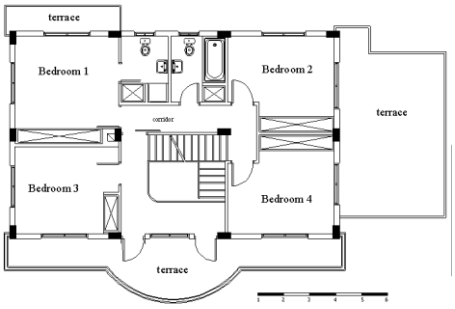
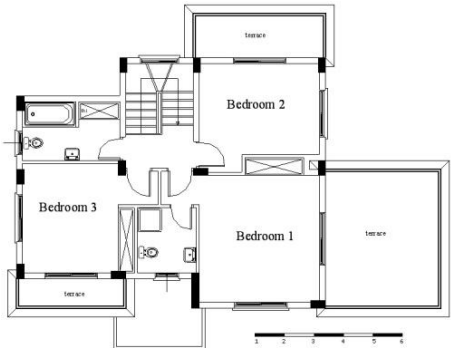
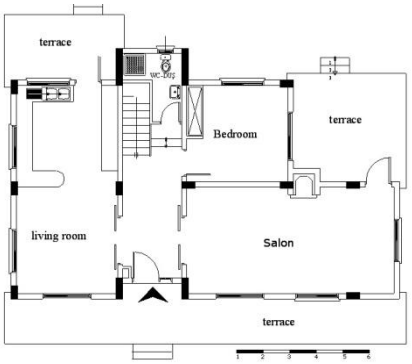
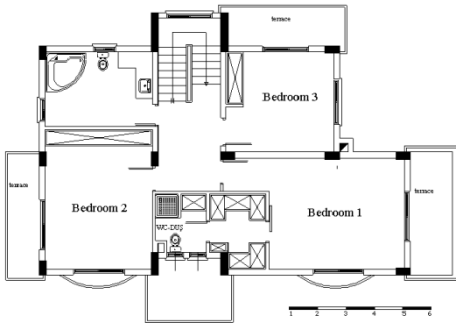
Plan type D closed area: 350m^3		
Plan type E closed area : 300.30m²		
Plan type F Gross area: 296m²		

Table 4.4. General information about Boğaz Cove Villa project

Generall information	**Boğaz Cove Villa**
Construction firm	Levent Homes Group
Location	Iskele
General information	This project consists of 31 detached houses which are in 2 types. These 2 types are different in size and plan organization
Construction method	Reinforce concrete & brick walls

Table 4.5.Plans of type 1 and 2 in Bogaz Cove Villa Project

Plan types	Ground floor plan	First floor plan
Plan type 1 gross area: 164m²		
Plan type 2 Gross area: 183m²		

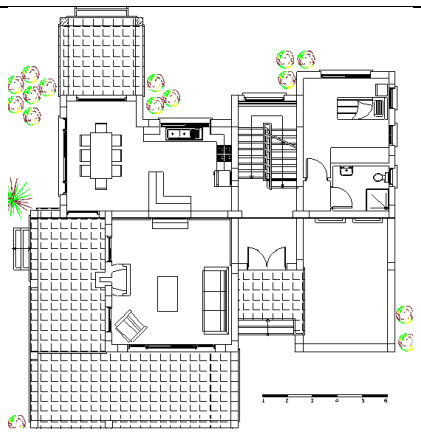
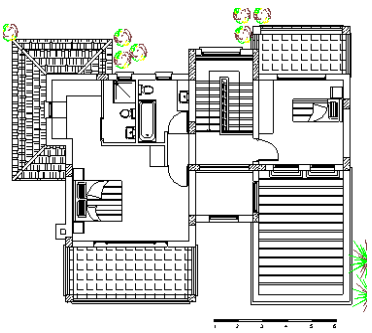
Table 4.6. General information about Pearl village project

General information	Pearl village
Construction firm	NorthernLand group
Location	Bahceler (Boğaz -Iskele)
General information	This project consists of 66 detached duplex villas with 2 types of plans.
Construction	concrete & brick walls
The pearl village is a project that comprises of a collection of 66 detached villas and 1 apartment blocks. The detached villas are in 2 types named Golden and Silver pearls. In this study the focus is on silver pearl village.	

Golden pearl village

Silver pearl village

Table 4.7.Plans of pearl project

	Ground floor plan	First floor plan
Silver pearl project Gross area: 258m²		

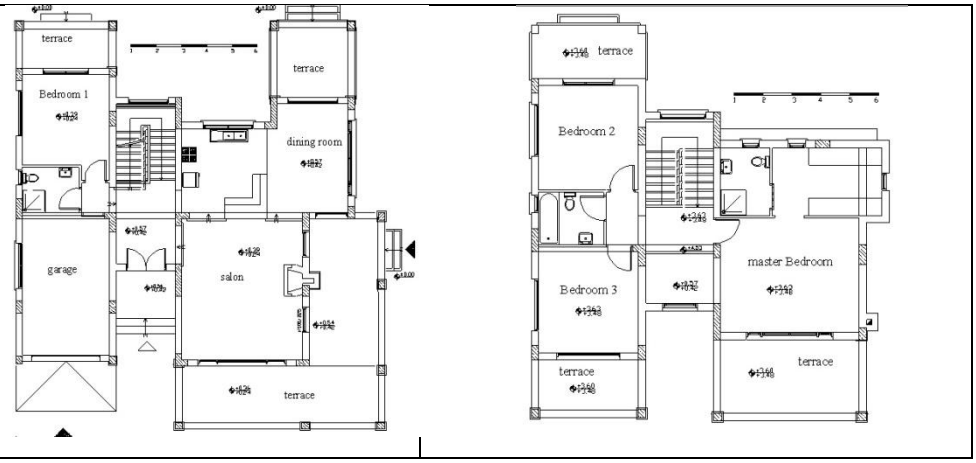
Golden pearl project Gross area: 285m^2	

Table 4.8. General information about Mutluyaka project

Information	**Mutluyaka houses**
Construction firm	Halken group
Location	Famagusta- Mutluyaka
General information	This project consists of 40 detached duplex villas with 3 types of plans.
Construction	concrete & brick walls

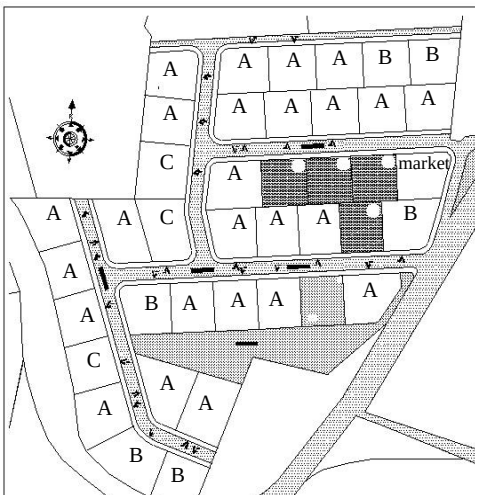


Table 4.9.Plans of type A, B, and C in Mutluyaka project.

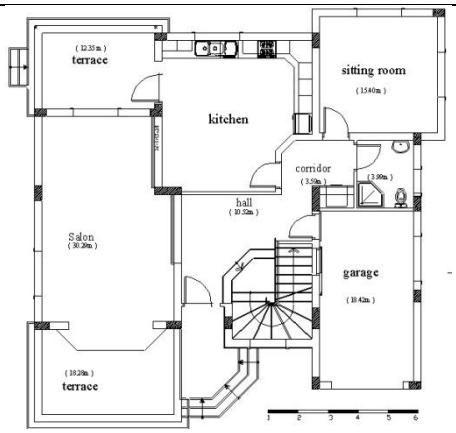
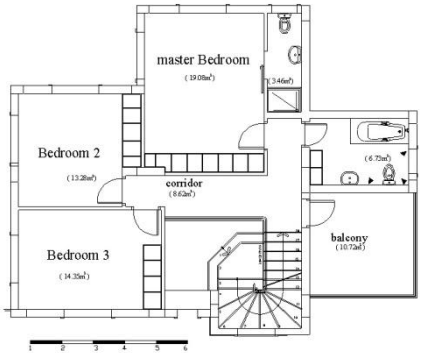
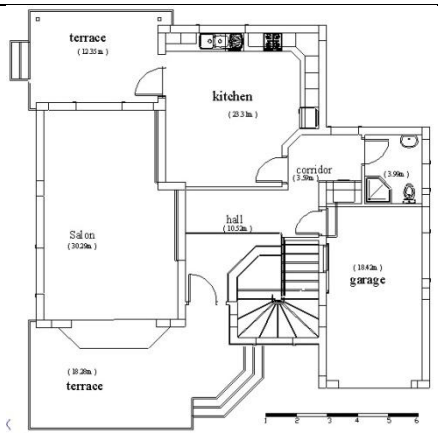
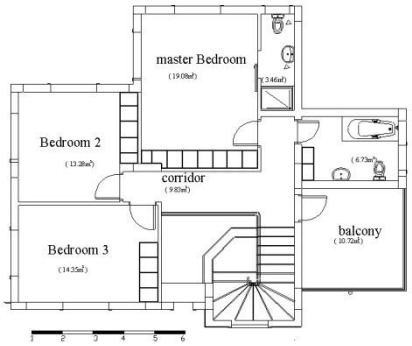
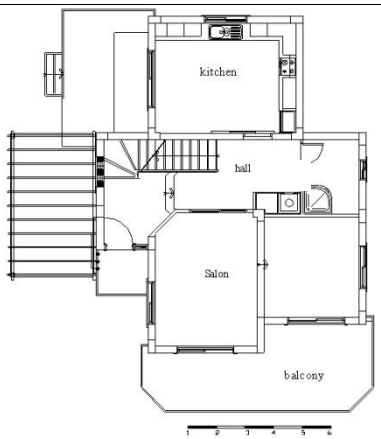
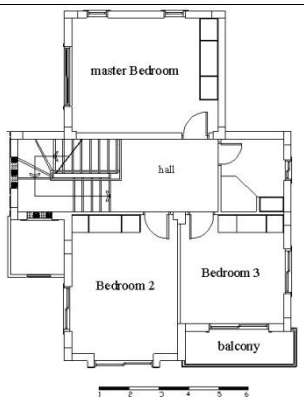
Plan types	Ground floor plans	First floor plans
Plan type A Gross area: 270 m²		
Plan type B Gross area: 250 m²		
Plan type C Gross area: 215 m²		

Table 4.10.General information about Dovec project

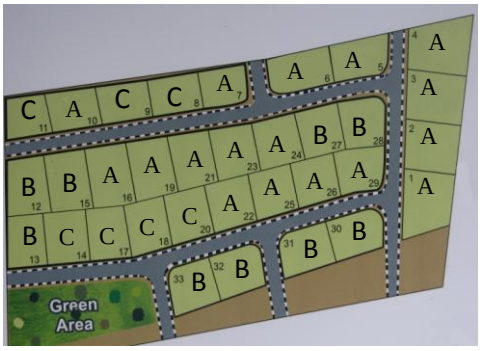
Information	**Dovec project**	
Construction firm	Dovec construction	
Location	Boğaz	
General information	This project consists of 33 detached duplex villas with 3 types of plans.	
Construction	concrete & brick walls	

Table.4.11. Plans of type A, B, and C in Dovec project.

Plan types	Ground floor plans	First floor plans
Plan type A Gross area: 290 m²		

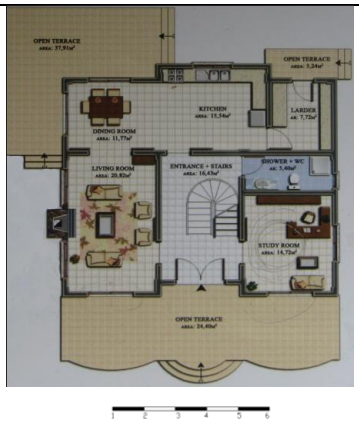
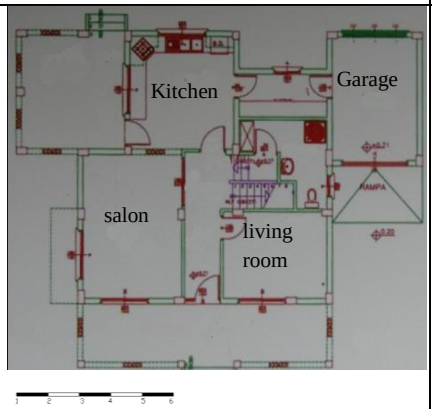
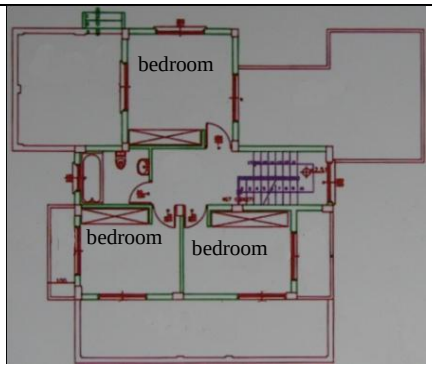
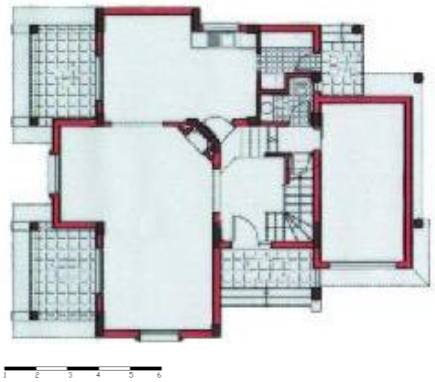
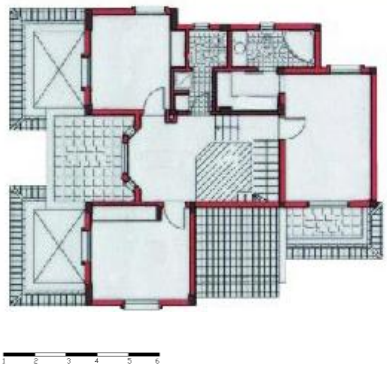
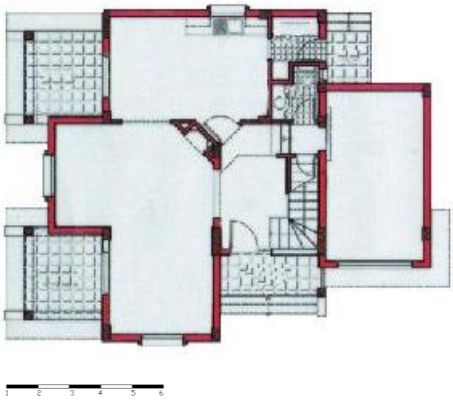
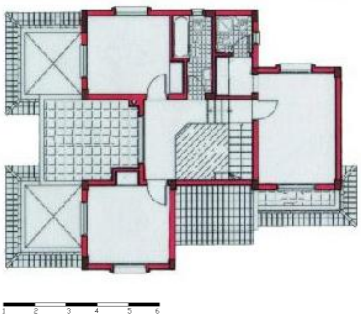
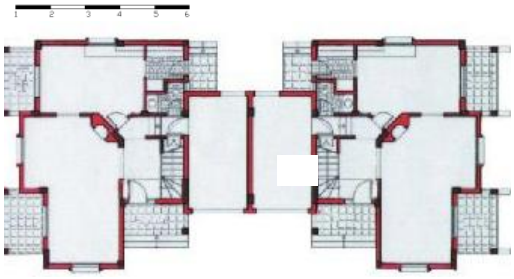
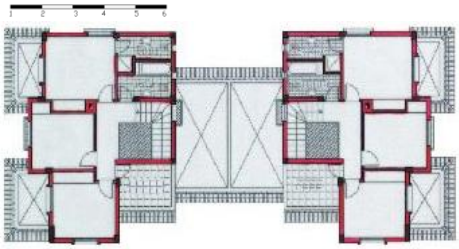
Plan type B Gross area: 280 m^2		
Plan type C gross area: 240 m^2		

Table 4.12.General information about Unique Salamis Villas project

Information	**Unique Salamis Villas**
Construction firm	İlkay Genç Group
Location	Salamis-Famagusta (7Km from city center)
General information	This project consists of 21 detached triplex villas with 2 types of A and B. 10 semi-detached duplex villas with 1 type of plan
Construction	concrete & brick walls

Table 4.13. Plans of type A, B, and C in Unique Salamis Villas project.

Plan types	Ground floor plans	First floor plans
Plan type A, triplex villa Gross area: 233 m²		
Plan type B Triplex villa Gross area: 218 m²		
Plan type C Duplex villa Gross area: 197 m²		

4.2.1. Evaluating Notions of Structural Flexibility in the Case Studies from Architectural Point of View

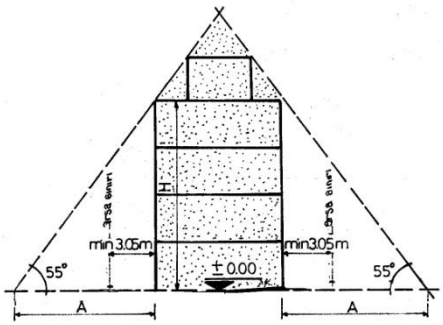
In all projects structurally frame system is used. Columns, beams and slabs are from reinforcing concrete and interior dividing walls are made up of brick with both 10 and 20cm thick. In some parts of the houses, beams divide the spaces into two parts. Actually, none of the flexible structural methods which were explained in chapter 2 are utilized in the cases. This can limit functional and cultural flexibility as well.

In fact, the cases were designed neither according to "incomplete buildings" method which focuses on the permanent elements and leave the rest for the users to fill in and change according to their wishes and needs; nor based on modular system that permanent modules are appropriate for various functions.

On the other hand, unlike the past periods, in recent times there are some legal limitations about maximum permitted extension both horizontally and vertically in the dwellings; and inhabitants are able to extend their houses based on the limitations.

Some of the regulations in housing design in North Cyprus, which are important and helpful in analysis of the case studies are mentioned in the following paragraphs.

There is a regulation about vertical extension of dwellings. The following figure indicates how maximum height of the buildings is calculated during design stage. According to Fasil 96:

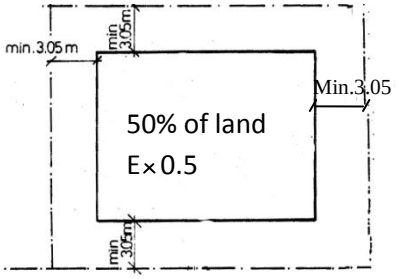


A: width of road

B: height of building

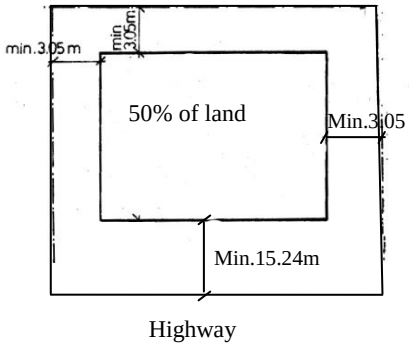
H: AXtg55 (tg55= 1.428)

According to Fasil 96, maximum construction area is 50% of the land if there is no secondary building in the site. On the other hand, all buildings must be 3.05 meters away from the site boundaries.

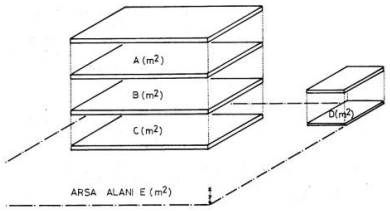


Site Area = E (m^2)

If there is a highway in front of the building, the distance between house and site boundaries must be 15.24m.



According to fasil 96, maximum usage area can be the land area multiplied by 2.2.



$$\frac{A\ (m^{2)} + B\ (m^{2)} + C\ (m^{2)} + D\ (m^{2)}}{E\ (m^{2)}} = 2.2$$

Site Area = E (m^2)

In all projects, due to inclined roofs and the mentioned legal limitation users may not extend their houses vertically based on their needs.

Horizontal extension in component scale can be restricted due to legal limitations and building codes as well as limited land area that does not allow users to have extension in component scale.

In fact, the gross area in the selected cases is ranging from 150m^2 to 350m^2 and total land area is also ranging from 500m^2 to 800m^2. Based on the regulation that 50% of land can be used as construction area, construction firms tried to make best use of land area so with considering the legal limitation (the minimum distance between dwellings and the site boundary must be 3.05m), it is only possible to have maximum extension of 2m outside the dwellings in site scale (fig. 4.1) (fig.4.2).

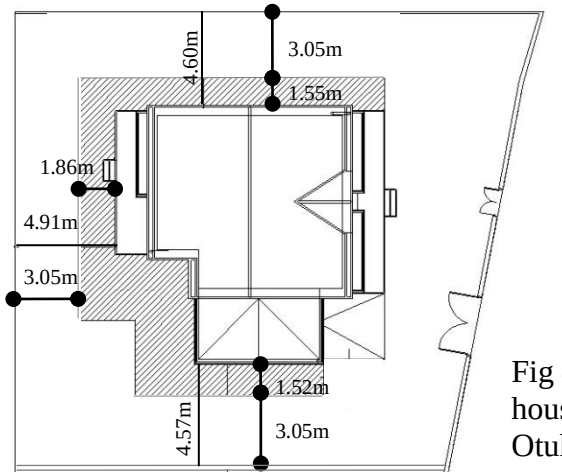


Fig 4.1. Possibility of extension outside the houses up to 3.05m to the site boundaries in Otuken project, houses of type A

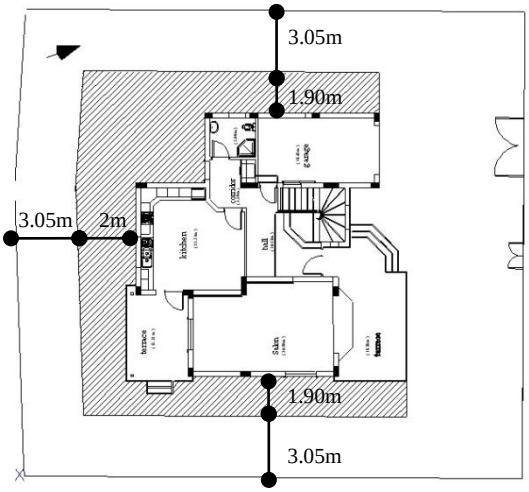


Fig 4.2. Possibility of extension outside the houses according to legal limitation in Mutluyaka project, houses of type B

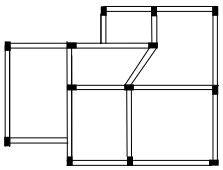
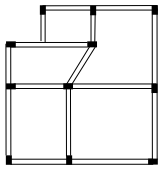
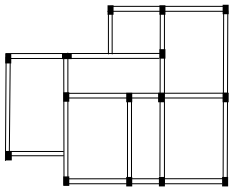
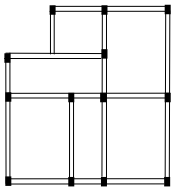
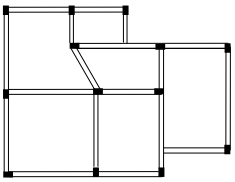
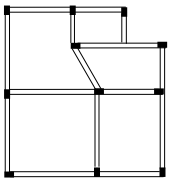
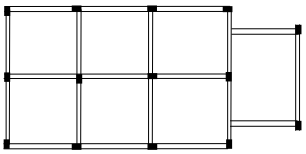
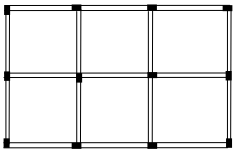
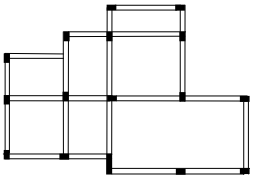
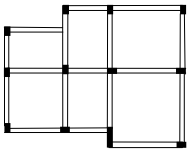
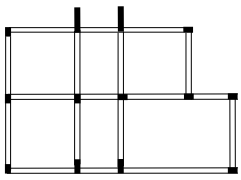
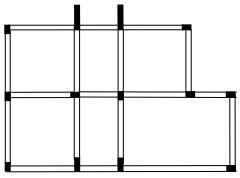
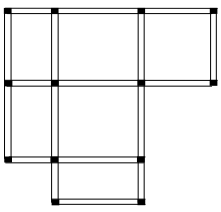
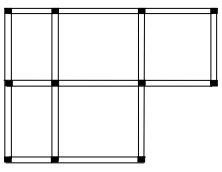
In fact, it can be very time and cost consuming for them to extend their houses only 1 or 2 meters. For instance in the houses of type 1 in Boğaz Cove Villa project, it can be attainable to extend the living room up to 3.05m by removing the non load-bearing wall but the indicated existing column can restrict the extension.(fig.4.3).

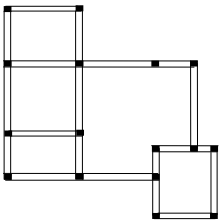
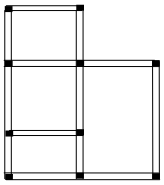
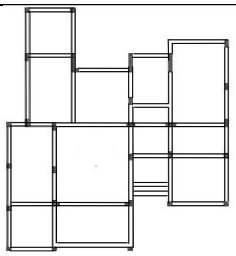
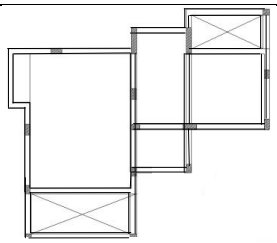
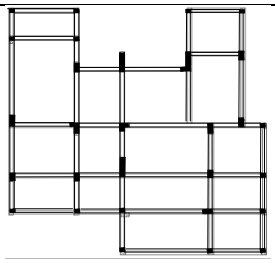
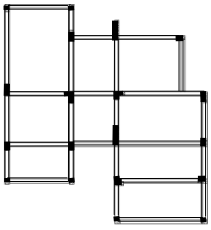
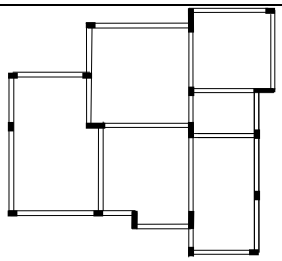
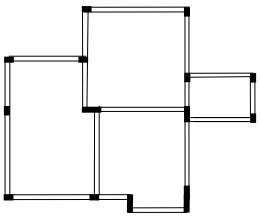
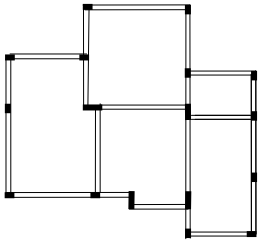
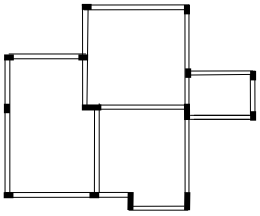
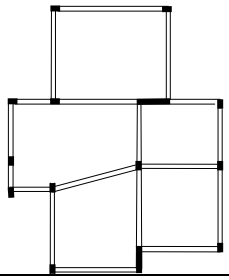
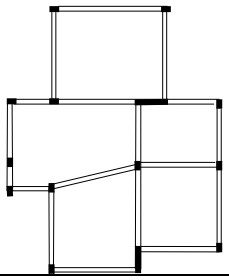
Fig 4.3. the existing column can restrict the horizontal extension in building scale

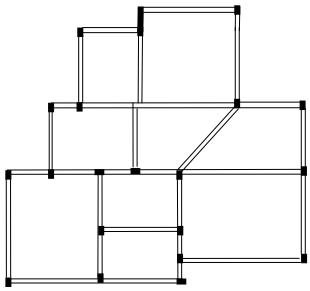
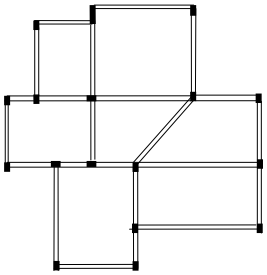
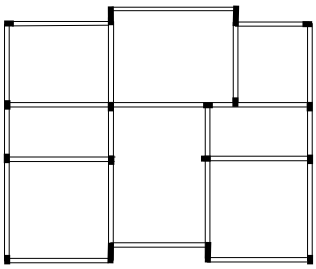
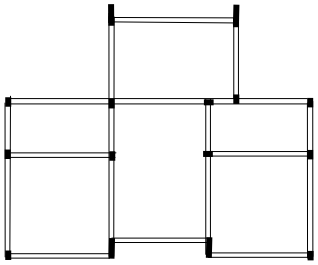
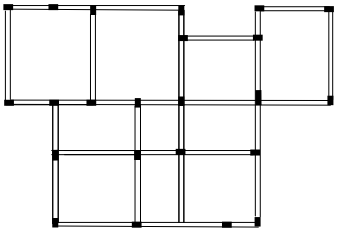
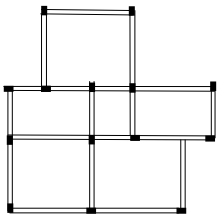
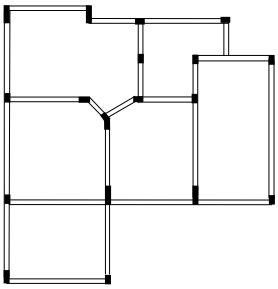
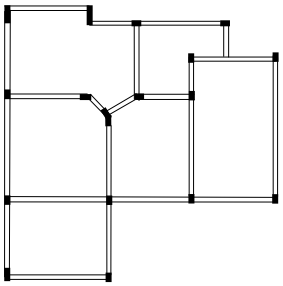
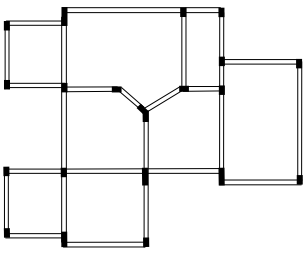
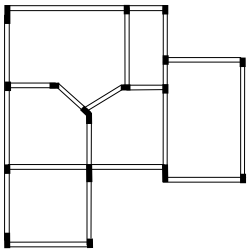
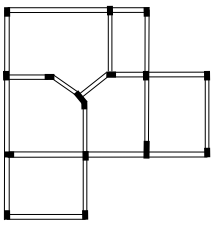
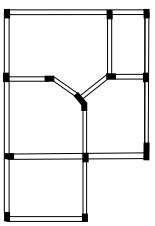
On the other hand existing non-movable dividing walls and columns and beams may restrict users to extend their houses in building scale.

In the following table, structural plans of all case studies have been drawn by the author to clarify how the columns and beams can limit extension and division in building scale (table.4.13).

Table 4.14. Structural plans of all case studies

	Ground floor	First floor
Ötüken project Type A		
Ötüken project type B		
Ötüken project type C		
Ötüken project type D		
Ötüken project Type E		
Ötüken project Type F		
Boğaz Cove Villa project Type 1		

Boğaz Cove Villa project Type 2		
Silver Pearl project		
Golden Pearl project		
Mutluyaka project Plan type A		
Mutluyaka project Plan type B		
Mutluyaka project Plan type C		

Dovec project. Plan type A		
Dovec project. Plan type B		
Dovec project. Plan type C		
Unique Salamis Villas Plan type A		
Unique Salamis Villas Plan type B		
Unique Salamis Villas Plan type C		

Horizontal division in building scale can be achieved by using some movable partitions. But existing columns and beams may restrict horizontal division as well.

On the other hand, vertical division during design stage can be feasible in all case studies because of accessibility to recent technologies, modern structure and materials. The designer have the ability to design a house with 2 separated floors during design process but during usage stage it cannot be feasible because of two reasons. In all cases stair box, which is a permanent and fixed element, is located inside the houses and changing its location into outside cannot be achieved so this can limit the floor division. On the other hand, in all cases, private and public zones are in separate floors, the bedrooms are in upper floor and kitchen and living rooms are in the ground floor so each floor does not include all essential spaces such as kitchen, bath room and WC.

In the following chart, summary of notions of structural flexibility in 19 cases are mentioned briefly.

As a conclusion it can be stated that according to the evaluation chart, the case studies are not flexible enough structurally. Actually, in recent times, unlike the past periods, limited land area and the building codes and regulations limit users to have extension outside their dwellings based on their needs. In other words, according to the mentioned regulations, users in the selected cases are able to extend the spaces up to 2 meters outside the dwellings. On the other hand, non-flexible structural organization and non-movable brick dividing walls can also restrict users to extend some spaces within the interior organisation. Vertical and horizontal divisions are also restricted because of structural organization, limited heights and space dimensions. Non-flexible structural organization and existing non-movable brick dividing walls restrict them to make internal changes due to beams which are coming down the slab as well as the columns.

Due to legal limitations and inclined roofs, vertical extension is also restricted during usage stage.

4.2.2. Evaluating Notions of Functional Flexibility in the Case Studies from Architectural Point of View

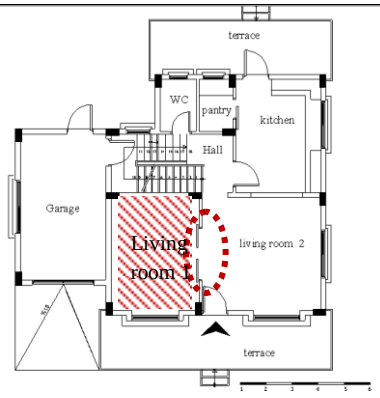
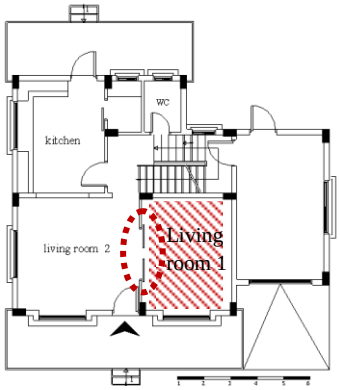
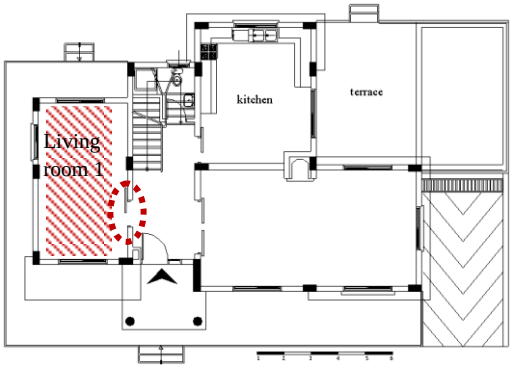
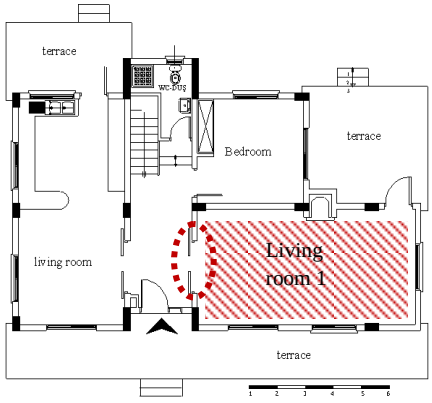
According to Friedman (2002), the traditional residential design and construction process often tends to ignore the occupants' evolving needs. When designers drawn up plans, the rooms have clear and defined functions. The uses are marked on the drawings themselves: master bedroom, bedroom or kitchen to further clarify these notations, architects also draw furniture to provide a sense of scale for the space. These characteristics restrict adaptability and functional changes in homes.

The selected case studies are not exceptions as well. Designers did not utilize any strategies during design and construction process for achieving functional flexibility in usage stage. In all cases, as it was indicated in the plans, they defined the rooms'

function as well as the arrangement of furniture clearly. Actually, designers did not leave the interior for the users to fill in and change it based on their wishes and needs and this can restrict functional changes in houses.

According to the above statements, convertibility may be restricted in the case studies. In fact, in most of the cases it can be possible to exchange function of a few spaces into another function especially in the ground floor but not in all spaces. In other words, just a few spaces have potential for convertibility in the cases. For instance, in the all types of houses in Ötüken project, it can be possible to convert the living room 1 in the ground floor into another function during usage stage. For instance, living room 1 can be converted into a bedroom during night and during the day, it can be utilized as a living room again (table.4.16).

Table 4.16. possibility of converting living room 1 into a bedroom during the night and convert it into living room or sitting room during the day by opening and closing the door or using movable partitions in Ötüken project.

Plan Type A (ground floor)	Plan Type C (ground floor)
	
Plan Type E (ground floor)	**Plan Type F (ground floor)**
	

The houses of type B and C in Doves project are other examples that have potential for flexibility just in a few spaces (fig.4.4).

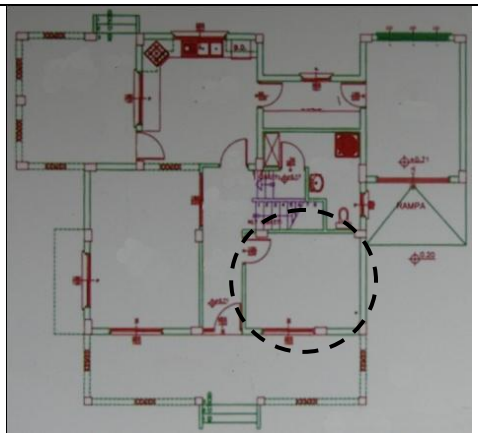
plan type B (ground floor)	plan type C (ground floor)
	

Fig 4.4.possibility of exchanging function of spaces into another function during the day

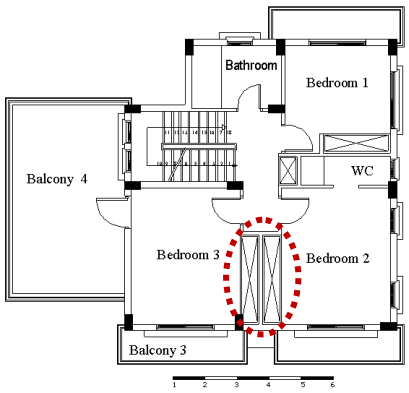
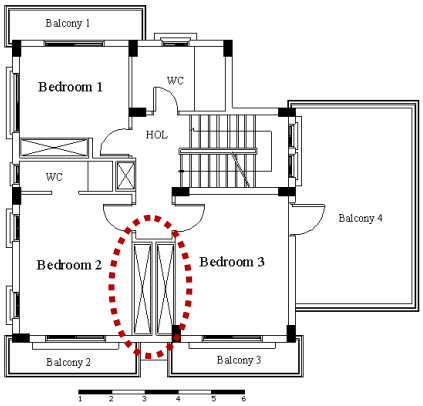
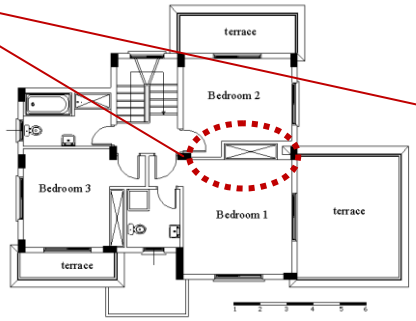
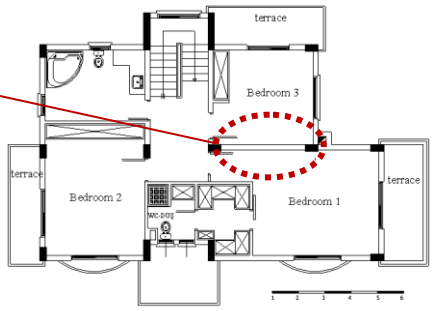
On the other hand, defined and clear functions restricted multi-functionality of the spaces as well.

Yard is also utilized for leisure activities and fun, unlike the courtyard in the rural houses which was utilized as a multi functional space. Just living room has the potential of having different functions at the same time like, watching TV, eating, studying and sleeping. So, it can be said that multi-functionality can only take place in living room in all case studies.

In addition, achieving multi-functionality through minor structural modifications can be achieved in most of the case studies especially in the first floor but it can be time and cost consuming.

For instance, in Ötüken project versatility could be achieved in the upper floors through removing the dividing wall and cupboards between two bedrooms and enlarging the space and using it as a multi functional space (table.4.17).

Table 4.17. achieving versatility by removing the dividing wall and cupboards between the two bedrooms and enlarging the space and using it as a multi-functional space.

	Plan Type A (first floor plan)	Plan Type C (first floor plan)
		
	Plan Type E (first floor plan)	Plan Type F (first floor plan)
The location of column and beam may prevent users from creating an open and multi-functional space.		

In two types of houses in Boğaz Cove Villa project and all types of houses in Mutluyaka project, similar strategy can be utilized in the upper floor for achieving versatility as well. While in Pearl project, houses of type A and B in Dovec and Unique Salamis Project, the houses do not have potential for achieving versatility (fig.4.5)

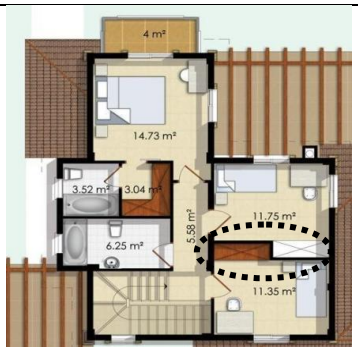
Type 1 (first floor)	Type 2 (first floor)
	

Fig 4.5. achieving versatility by removing the dividing wall and cupboards between the two bedrooms and enlarging the space in Boğaz Cove villa project

On the other hand, the users are not able to separate and rejoin the rooms whenever they want, based on their needs because of non-movable brick dividing walls. Only, by using movable partitions, it can be possible to divide a room into two parts and rejoin it at a later time but it should be considered that the rooms' dimensions are limited. For instance, in all cases, bedrooms are about 12m² and this is too small to divide them into two, hence the created spaces are too small to use them appropriately.

All case studies include open plan kitchen, except six projects, and it can be possible to convert the open kitchen into a closed one by using dividing partitions or closing the open kitchen can be attainable as well by removing the brick dividing walls that can be time and cost consuming.

As it was mentioned before, in all cases, designers defined the rooms' functions clearly. They also drew the furniture to provide a sense of scale for the space. Although furniture is not fixed, defined functions, limited size of the rooms and fixed cupboards may restrict users to arrange furniture in different ways.

Despite this, arranging furniture can still be feasible in all cases, especially in living room, while in bedrooms it is more limited because of existing fixed cupboards and limited size of the rooms.

On the other hand, the selected cases may not be suitable for people who have physical disabilities to live in them, because of existing bedrooms in the upper floor. In addition, it may not be also possible to convert a room in the ground floor into a bedroom permanently because of fixed and defined functions as well as the limitation in space dimensions. Adding one room in the ground floor can have legal limitations as well. So, it can be too difficult for disabled people to live in such circumstances.

According to the architectural drawings, it can be said that the cases are not adaptable to climate. Actually, in all cases except Silver Pearl Village, the houses were not in the same orientation in the site plans and rotated according to the location and entrance of the land.

For instance in Ötüken project, the houses of type A were not oriented towards north-south direction to take advantages of sun but rotated according to the position and entrance direction of the land (fig.4.6).

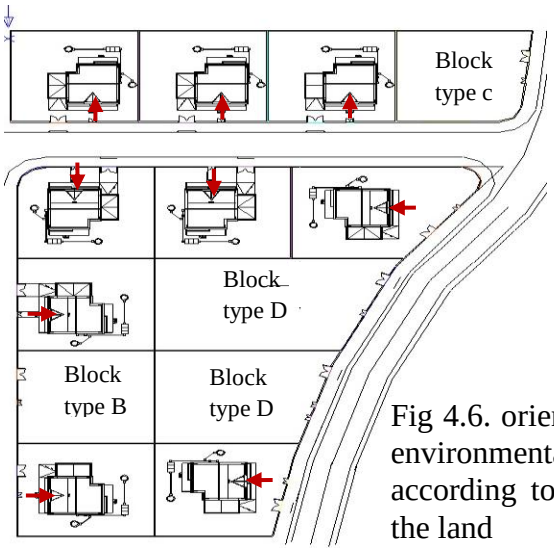


Fig 4.6. orientation of type A houses is not based on environmental control principles. They were oriented according to the position and entrance direction of the land

The houses of type A in Mutluyaka project are other examples which were oriented according to the position and entrance direction of the land (fig.4.7).

Fig 4.7. orientation of houses of type A in Mutluyaka project according to the position and entrance direction of the land

On the other hand, in all cases the windows were located in 4 sides of the houses and they are not in appropriate directions for catching the prevailing wind. In fact, no strategies were used for providing natural ventilation in the selected houses. In none of the case studies, the openings are opposite to each other for cross ventilation. On the other hand, no external sun controlling devices are used in the projects as well, only interior curtains can be utilized for controlling the sun which is not sufficient for Cyprus climate.

In all case studies no strategies or elements were used for shading during summer, while in vernacular architecture, there was an arcaded semi-open space in front of the closed spaces in south direction. As explained in chapter three, the semi-open space was beneficial for providing shadow to the habitable rooms in summer but allowed the penetration of sunshine in winter. It was also utilized as a multi functional space. Actually, in all case studies the terraces and balconies are open to sky and no elements were used for shading so inhabitants cannot use it during summer (fig.4.8).

Fig 4.8. No strategies or elements were used in windows or terraces for providing shadow during summer. The terraces and balconies are open to sky

In Silver Pearl project, designers designed arcaded terraces and balconies which look similar to the arcaded semi-open spaces (*sündürme)* in the rural houses. But, unlike *sundurme* that provided thermal comfort for the inhabitants, the arcaded terraces are just used as decoration because they are roofless, unlike *sündürme,* and they cannot provide shadow during summer (fig.4.9). So it can be stated that designers just copied and pasted the traditional elements in the houses without

considering the concept behind them (Dinçyürek & Turker, 2007; Turker & Pulhan, 2006).

Fig 4.9. Using arcaded semi open terraces as decoration

Reinforced Concrete skeleton constructional system with non-insulated brick walls were utilized in all cases instead of using local materials such as sun-dried mud brick or sand. In fact, concrete has gained popularity because of ease of construction and maintenance and people prefer them. Concrete construction has a "modern" value and therefore adds prestige to its owners. So, using local materials and natural resources has been ignored in recent mass housing of North Cyprus.

In the following chart, notions of functional flexibility will be described briefly.

According to the evaluation chart, it can be stated that none of the case studies are functionally flexible enough from architectural point of view.

Generally, it should be mentioned that throughout centuries, meaning and use of the house changed according to the communities' changing condition such as economic situations, increase in populations, changing lifestyles and structure of the families (Friedman, 2011). In the past period, large and multi-functional rooms were observed while in the beginning of 20th century, lifestyle of people started changing and separation of spaces became extreme. Children were separated from parents and odd assortment of function rooms appeared such as living room, dining room, lobby and etc. Every aspects of domestic existence were compartmentalized and it affected the layout of house design (Geddis, 2008).

With considering this fact, designers are expected to provide a more flexible environment that allows users to control their environment and change the interior spaces of their houses based on their changing needs. While, in all case studies designers defined the rooms' functions clearly and dimensions of most of the spaces are suitable for only a specific function. On the other hand, non-movable brick dividing walls and fixed cupboards can restrict users to change the dimension or space organization of interior spaces as well. All these characteristics can restrict functional flexibility in the house. For instance, in most of the case studies versatility, convertibility and multi functionality can be achieved in only one space or one floor not in all spaces so we cannot say that the spaces of the houses have multifunctional or versatile character.

In Silver Pearl project, the houses are more adaptable to climate than the other case studies but it cannot be enough. In fact, the designers just tried to utilize natural light effectively but they did not use any other resources such as wind for providing

natural ventilation and users have to use mechanical systems for achieving thermal comfort during summer. Environmentally sensitive materials were not used on external walls or interior design.

On the other hand, in all cases, although furniture are not fixed, the defined functions and limited size of most of the rooms as well as existing fixed cupboards, fixed telephone or TV sockets can restrict users to arrange them based on their tastes and needs.

4.2.3. Evaluating Notions of Cultural Flexibility in the Case Studies from Architectural Point of View

Cultural flexibility is more concerned with beliefs, attitudes and values of the users so it can be more related to the interior spaces and personalisation as well as external facade characteristics.

In fact, the house is a position that directly reflects the personality and status of the occupants, so architects are expected to design the houses in such a way to be adaptable to various users with different culture, beliefs, life styles and needs. The users should have the ability to change their conditions based on their needs, tastes and cultures.

After evaluating architectural drawings of the case studies, it was considered that the cases are not flexible structurally and functionally enough and this can negatively influence cultural flexibility as well. In other words, the following problems in the case studies may restrict users to personalize their houses based on their tastes:

-labelled and defined functions

-dimensions of most of the spaces are suitable for a specific function

-non-movable brick dividing walls and fixed cupboards that may restrict users to change the size and space organization of interior spaces of their houses based on their tastes.

Generally, leaving the interior for the users and using movable partitions, allow users to change the space locations and dimensions according to their tastes and needs while in all cases, 10cm or 20cm brick dividing walls which are non-movable, restrict users to enlarge and reduce the space dimensions whenever they want.

As Bakkaloglu states (2006), one of the necessary characters that form cultural flexibility can be a free open plan with movable interior partitions. Modular design with movable walls can be other important characters that can form cultural flexibility as well. This method was utilized in vernacular architecture of North Cyprus as well. The modules are standard and fixed in form, but it is possible to join two or more modules together or to divide a module into smaller modules. But in all cases the dimensions of most of the spaces are appropriate for a specific function and because of non-movable walls; users cannot separate and rejoin spaces based on their tastes and needs.

In most of the cases, designers abstracted and utilized some traditional architectural elements in the facades because of client's tastes without questioning the concept behind them, such as using local yellow stone just in some parts of the facades or arcaded terraces and balconies in all directions. Actually, the arcaded façade character has a symbolic meaning. On the other hand, in all projects the roofs are inclined not only for climatic design but also because of people's tastes and preferences (fig.4.10).

Ötüken Project	 Inclined Roofs Triangular entrance Arcs
Boğaz Cove Villa Project	 Inclined Roofs Fireplace and chimney Iron works-ferforge Yellow stone sills around windows Local yellow stone
Silver Pearl Project	 Inclined Roofs Fireplace and chimney Arcaded terraces Local yellow stone
Mutluyaka project	 Inclined Roofs Yellow stone sills around windows Local yellow stone at corners

Fig 4.10. Symbolic use of traditional architectural elements in facades of some projects

As it is indicated in fig.4.11, in all case studies there is a hierarchy among spatial components of the dwellings for providing privacy for the residents.

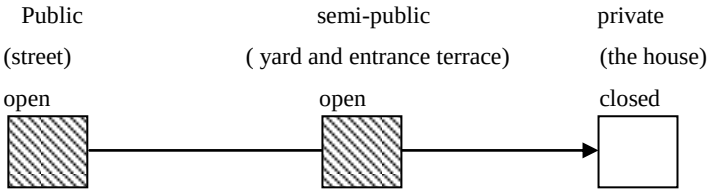


Fig 4.11. spatial relations ranging from public to private for providing privacy

In fact, there is not any direct access from Public Street to private and indoor spaces in the selected houses, but they enter through an open yard and/or entrance terrace. On the other hand, according to regulations, maximum height of the garden

walls cannot be higher than 1.20m (fasil 96, 1996) and due to this regulation; the yard and entrance terraces, which are open semi-public spaces have direct physical and visual contact with the streets although users can utilize plant fences for providing more privacy. Unlike the selected cases, most of the rural houses there are semi-open or semi-closed spaces (outer or inner hall), which were semi private spaces and had not direct physical and visual contact with the streets and this provide more privacy for interior spaces as well (fig.4:12). Actually, these spaces were transitional spaces between open and closed spaces and they were utilized as semi-private and multi-functional spaces while in recent architecture there is no semi-private space in the houses and terrace is an open space that have direct visual and physical contact with the streets.

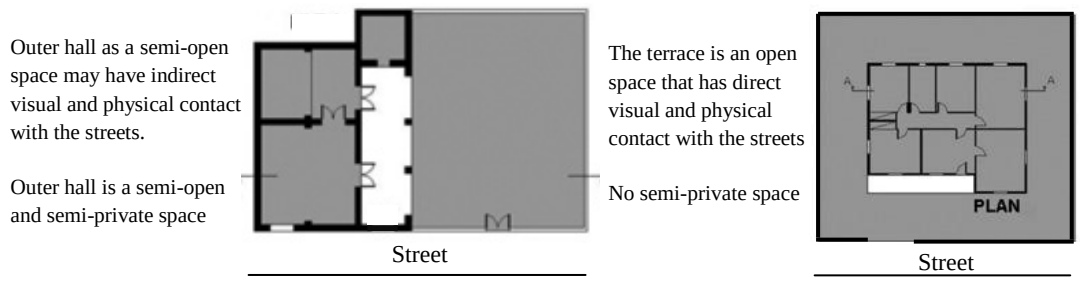


Fig 4. 12. Exterior privacy in vernacular and recent mass housing

In the selected dwellings, the designers also tried to separate public and private area inside the house by moving the private area into upper floor for providing more interior privacy. Although, it may not be suitable for the users with physical disabilities to live in these houses because of existing bedrooms on the upper floor. It is too difficult for them to use the stairs many times during the day so the bedrooms in the upstairs may become useless and adding a bedroom in the ground floor becomes obligatory.

On the other hand, during design stage, designers did not consider users and their cultural background in their designs so they designed houses with the following characteristics:

-Labelled spaces,

-Dimensions of most of the spaces are suitable for a specific function,

-Non-movable brick dividing walls,

-Fixed cupboards and fixed wardrobes,

These characteristics can restrict users to change their environment based on their tastes, beliefs and cultural backgrounds.

In the following chart, summary of notions of cultural flexibility in 19 cases from 6 companies will be mentioned briefly.

After evaluating architectural drawings of the 19 cases according to the flexibility criteria, it can be stated that none of the cases are flexible enough structurally functionally and culturally. The following reasons are the main reasons for lack of flexibility in the selected "build and sell" type of housing projects from architectural points of view.

- using non-flexible structural method
-defined and labeled functions
-limited dimension of most of the spaces (the dimensions are suitable for only a specific function)
-non-movable brick interior walls
-not locating wet spaces in a specific zone
-restricting furniture arrangements by using fixed cupboards,
-no adaptability to climate

Generally, it should be mentioned that in modern times legal limitations and limited land area may restrict users to make some exterior changes outside their dwellings such as vertical or horizontal extension. On the other hand, people's lifestyle has changed during the time and most of the inhabitants prefer to modernize their houses to present a civilized face to the world. By considering these facts, designers are expected to provide a flexible environment that allows users to change the dimension or space organization of interior space of their houses based on their needs and tastes.

In the next section, existing situation of the case studies is going to be evaluated in terms of flexibility in 3 different stages of design, construction and usage through questionnaire survey to find out how flexible the cases can be in different stages as well as today's needs of the existing inhabitants in terms of flexibility.

4.3. Evaluating Flexibility in Recent 'Build and Sell' Type of Housing Project in North Cyprus in Terms of Different Stages of Flexibility

The purpose of this section is to evaluate existing situation of the case studies in terms of flexibility in 3 different stages of flexibility (design, construction and usage) through questionnaires survey to find out how flexible the cases can be in different stages as well as today's needs of the existing inhabitants in terms of flexibility.

To achieve this aim, 3 series of questionnaires were prepared for three different stages of flexibility: design, construction and usage stages. The questionnaires, which were related to design and construction stages, were conducted by construction firms and the usage stage questionnaires were filled in by the existing inhabitants of the case studies.

The questions in design and construction stages are divided into two main groups (appendix A, B)

-Possibility of making the modifications related to exterior shell of the dwelling by users.

-Possibility of making the modifications, which are more related to interior spaces by users.

The questions in usage stage are divided into two main groups as well (appendix c).

- The inhabitants' needs for making the modifications related to exterior shell of their dwelling.

- The inhabitants' needs for making the modifications, which are more related to interior spaces.

4.3.1. Evaluating Flexibility in Recent 'Build and Sell' Type of Housing Project in North Cyprus in Design Stage

In this stage, the questionnaires (Appendix A), that include 21 questions were filled in by the 6 selected companies. And the following tables indicate the results about flexibility criteria in the selected case studies during design stage based on the companies' response.

Table 4.20.possibility of external changes that affect the exterior shell of the dwellings by the users during design stage

Construction firms	Maximum Customers	Extension outside the house	Changing Façade	changing Façade finishing material	Changing Form of roof
Noyanlar	Local	No	No	No	No
Dovec	Local	No	Yes +extra cost	Yes + extra cost	Yes + extra cost
Northernland	Local	No	No	No	No
Halken	Local	No	Yes + extra cost	Yes + extra cost	No
Ilkay Genc	International	No	No	No	No
Levent Homes	International	No	No	No	No

Number of Yes	0
Number of Yes+ extra cost	5
Number of No	19
Total number of replies	24

Findings indicate that most of the companies did not allow users to make changes at the exterior shell of their dwellings due to importance of similarity and unity among the dwellings as well as legal limitations.

The inhabitants did not have possibility of extending the spaces outside their dwellings in design stage. In other words, all companies did not allow users to make this change in their dwellings because of legal limitations as well as importance of similarity and unity among the dwellings. Only 2 companies gave customers

possibility of changing the façade or façade finishing materials during design stage by asking extra cost.

Table 4.21. possibility of interior changes that have no effect on the external shell of the dwellings by the users during design stage

Construction Firms	space organization	function of space	interior finishing material	model of kitchen	electricity system	pipe system	fireplace
Noyanlar	Yes + extra cost	Yes	Yes	Yes	No	No	Yes
Dovec	Yes+ extra cost	Yes+ extracost	Yes	Yes	Yes+ extra cost	Yes	Yes
Northernland	Yes+ extra cost	Yes	Yes	Yes	No	No	Yes
Halken	Yes + extra cost	Yes	Yes	Yes	Yes	Yes	Yes
Ilkay Genc	Yes + extra cost	Yes + extracost	Yes	Yes	Yes + extra cost	No	No
Levent Homes	Yes+ extra cost	Yes	Yes	Yes	Yes	No	No

Number of Yes	24
Number of Yes+ extra cost	10
Number of No	8
Total number of replies	42

Findings reveal that possibility of making interior changes by users during design stage is higher than external changes that affect the exterior shell of the dwellings and most of the companies gave the customers possibility of changing the interior spaces of their houses during design stage although they had to pay extra cost for some of these changes.

All companies allowed users to change space organization of interior spaces (wall arrangement, size of interior spaces …) by demanding extra cost.

On the other hand, they allowed the users to change interior finishing materials and model of their kitchens (converting closed kitchen into open one or vice versa) without demanding extra cost.

Four companies out of 6 did not allow users to change pipe systems (changing the location of wet spaces) while 4 companies out of 6 allowed users to change electricity system by demanding extra cost.

4.3. 2.Evaluating Flexibility in Recent 'Build and Sell' Type of Housing Project in North Cyprus in Construction Stage

In this section, flexibility in construction stage is going to be evaluated through surveying questionnaires (appendix B). The questions are similar to the questions in design stage. The following tables indicate the results about flexibility criteria in the selected case studies during construction stage based on the companies' response.

Table 4.22. possibility of external changes that affect the exterior shell of the dwellings by the users during construction stage

	Extension outside	**Changing Façade**	**Changing Façade finishing material**	**Changing Form of roof**
Noyanlar company	No	No	No	No
Dovec	No	Yes + extra cost	Yes + extra cost	Yes + extra cost
Northernland	No	No	No	No
Halken	No	No	Yes + extra cost	No
Ilkay Genc	No	No	No	No
Levent Homes	No	No	No	No

Number of Yes	0
Number of Yes+ extra cost	4
Number of No	20
Total number of replies	24

Findings indicate that the obtained results from surveying questionnaires in construction stage are similar to the obtained results in design stage and most of the companies did not allow users to make some external changes at the exterior shell of the dwellings in construction stage as well due to importance of similarity and unity among the dwellings of the projects as well as legal limitations.

Table 4.23. possibility of changing interior spaces that have no effect on external shell of the dwellings by the users during construction stage

	Space organization	Function of space	Finishing material	Model of kitchen	Electricity system	Pipe system	Fireplace
Noyanlar	Yes + extra cost	Yes + extra cost	Yes + extra cost	Yes	No	No	Yes
Dovec	Yes+ extra cost	Yes+ extra cost	Yes+ extra cost	Yes+ extra cost	Yes + extra cost	Yes+ extra cost	Yes
Northernland	Yes+ extra cost	Yes+ extra cost	Yes+ extra cost	Yes+ extra cost	No	No	No
Halken	Yes + extra cost	Yes + extra cost	Yes + extra cost	Yes+ extra cost	No	No	Yes
Ilkay Genc	Yes + extra cost	Yes + extra cost	Yes + extra cost	Yes+ extra cost	Yes	No	No
Levent Homes	Yes+ extra cost	Yes+ extra cost	Yes+ extra cost	Yes+ extra cost	No	No	No

Number of Yes	5
Number of Yes+ extra cost	25
Number of No	12
Total number of replies	42

The findings reveal that possibility of making interior changes by the users are restricted more during construction stage. In fact, in design stage, the total number of yes is 34 out of 42 while the number of yes + extra cost is 10 out of 42. In construction stage, the total number of yes is 30 out of 42 while the number of yes+ extra cost is 25 out of 42. It indicates that making modifications by demanding extra cost in design stage is lower than construction stage so most of the changes in construction stage required extra cost and it is against flexibility concept.

All companies allowed users to change space organization of interior spaces, function of spaces as well as interior finishing materials by asking extra cost.

All companies, except one, allowed users to change the model of their kitchens by demanding extra cost.

On the other hand, five companies allowed users to change the location of wet spaces.

Based on the findings, it can be stated that design stage is more flexible than construction stage in the selected case studies. On the other hand, possibility of making interior changes was higher than the ones related to the external shell of the selected cases.

4.3.3. Evaluating Flexibility in Recent 'Build and Sell' Type of Housing Projects in North Cyprus in Usage Stage

In this stage, the questionnaires (appendix C) were filled in by the existing inhabitants of the selected case studies to find out how flexible the cases can be in usage stage as well as today's needs of the existing users in terms of flexibility criteria.

77 inhabitants out of 123 filled in the questionnaires and according to the findings, most of the existing inhabitants are local families, who are middle-aged couples with one or two children and most of them bought their houses during construction stage.

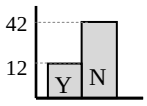
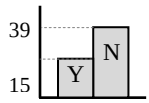
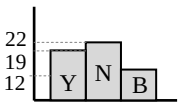
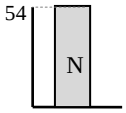
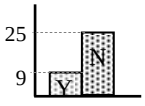
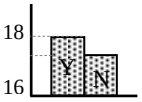
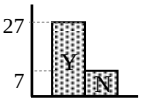
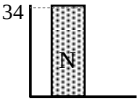
In the following table, the information about the number of plots in each project and the number of existing inhabitants will be mentioned.

Table 4.24.general information about the number of plots and sold houses

Construction firms	Projects	Number of total plots	Number of sold houses	Number of families who fill in the questionnaires
Noyanlar	Otuken	22	22	15
Dovec	Dovec	33	23	12
Northernland	Pearl project	66	27	14
Halken	Mutluyaka	40	10	7
Ilkay Genc	Salamis	21	21	18
Levent Homes	Bogaz villa	31	20	11
Number of families who filled the questionnaires		total: 213	Total : 123	77 inhabitants or families out of 123 sold houses

The following tables indicate the obtained results from surveying today's needs of existing inhabitants in terms of flexibility through questionnaires in the case studies.

Table.4.25.inhabitants' needs for making external changes, which affect the exterior shell of the dwellings during usage stage

nationalities	No of users	Number of users in each stage		extension			facade			Material of façade			Form of roof		
				y	N	B	Y	N	B	Y	N	B	Y	N	B
Local	65	D	0	0	0	0	0	0	0	0	0	0	0	0	0
		C	49	11	38	0	15	34	0	19	20	10	0	49	0
		U	28	9	19	0	14	14	0	22	6	0	0	28	0
International	12	D	1	0	1	0	0	1	0	1	0	0	0	1	0
		C	5	1	4	0	0	5	0	0	2	2	0	5	0
		U	6	0	6	0	4	2	0	5	1	0	0	6	0
Total inhabitants	77	D	1	0	1	0	0	1	0	1	0	0	0	1	0
		C	54	12	42	0	15	39	0	19	22	12	0	54	0
		U	34	9	25	0	18	16	0	27	7	0	0	34	0
Bar chart related to the total inhabitants who bought their houses during construction stage and their needs for making external changes				 need for extension			 need for façade modification			 need for façade material modification			 need for roof modification		
Bar chart related to the total inhabitants who bought their houses during usage stage and their needs for making external changes				 need for extension			 need for façade modification			 need for façade material modification			 need for roof modification		

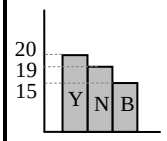
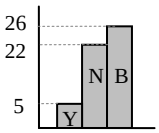
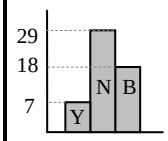
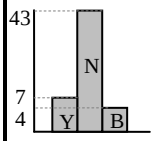
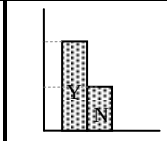
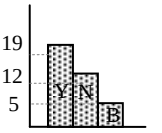
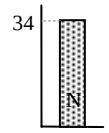
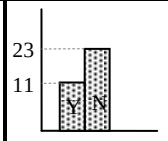
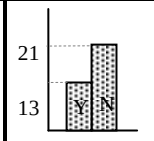
Yes (Y): yes, we need No (N): no we do not need Before (B): we did it already

Findings indicate that most of the existing inhabitants (85%) are local people who bought their houses during construction stage and they had the chance to contribute in the formation of their houses and made some changes in their houses based on their needs and tastes by paying extra cost.

Obtained results from the above table indicate that most of the inhabitants (both local and international) do not need to make external changes that affect the exterior shell of their houses such as extension, changing facades, changing the size or location of the openings, and changing the form of roofs while changing the façade finishing material is mostly preferred by most of the inhabitants.

Most of the inhabitants who bought their houses in construction stage changed the façade finishing materials based on their taste; while the users, who bought their houses in usage stage need to change them and personalize their houses based on their tastes. On the other hand, all inhabitants are happy about the form of their roofs.

Table 4.26. inhabitants' needs for making interior changes that have no effect on external shell of the dwellings during usage stage

Nationality	No of users	Number of users in each stage		1.Space organization			2.Function of space			3.Use space for various purposes		4.Model of kitchen			5.Electricity system		
				Y	N	B	Y	N	B	Y	N	Y	N	B	Y	N	B
Local	65	D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		C	49	18	17	14	5	19	25	0	49	7	25	17	6	40	3
		U	28	17	11	0	12	9	7	0	28	10	18	0	11	17	0
international	12	D	1	0	0	1	0	0	1	0	1	0	1	0	0	1	0
		C	5	2	2	1	0	3	1	0	5	0	4	1	1	3	1
		U	6	4	2	0	2	3	2	0	6	1	5	0	2	4	0
total	77	D	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0
		C	54	20	19	15	5	22	26	0	54	7	29	18	7	43	4
		U	34	21	13	0	19	12	5	0	34	11	23	0	13	21	0
Bar chart related to the total inhabitants who bought their houses during construction stage and their needs for making internal changes																	
Bar chart related to the total inhabitants who bought their houses during usage stage and their needs for making internal changes																	
				Need for changing space organization			need for changing function of spaces			need for multi-purpose space		need for changing the model of kitchen			need for changing electricity system		

6.Pipe system			7.fireplace			8.Finishing material			9.Furniture rearrangement			10. Do you have enough Privacy related to your:						11.Do you have enough space for helding a ceremony	
												openings		wall		layout			
Y	N	B	Y	N	B	Y	N	B	Y	N	B	Y	N	Y	N	Y	N	**Y**	**N**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	47	1	20	23	6	13	9	27	30	9	10	47	2	21	28	49	0	32	7
4	24	0	13	15	0	19	5	4	19	6	3	24	4	9	19	28	0	26	2
0	1	0	0	0	1	0	0	1	0	0	1	1	0	1	0	1	0	1	0
0	5	0	0	2	3	0	1	4	4	1	0	5	0	5	0	5	0	5	0
0	6	0	2	4	0	5	1	0	5	1	0	6	0	5	1	6	0	6	0
0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	1	0	1	0
1	52	1	20	25	9	13	10	31	34	10	10	52	2	26	28	54	0	37	7
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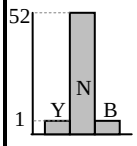			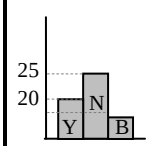			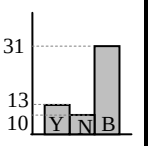			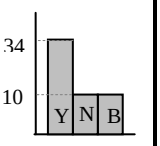			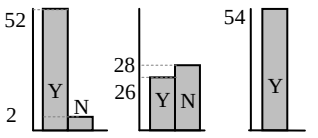						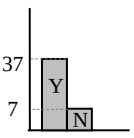		
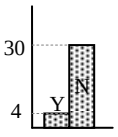			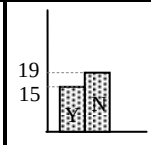			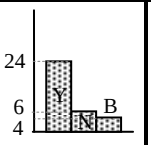			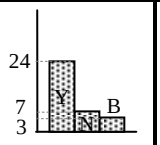			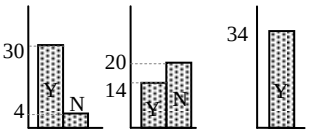						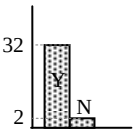		
Need for changing pipe system			need for changing fireplace			need for changing interior materials			need for rearranging furniture			need for privacy						need for more or larger space	

Yes (Y): yes, we need No (N): no we do not need Before (B): we did it already

Findings reveal that the existing inhabitants (both local and international) mostly prefer to change the interior spaces of their houses and personalize them based on their needs and tastes instead of exterior changes.

Findings also indicate that most of the local people, who bought their houses during construction and usage stages need more privacy related to the height of garden walls while international users did not. In fact, according to legal limitations maximum height of boundary walls can be 1.20 m and one of the solution for removing this problem is using plant fence for providing more privacy. Only, a few inhabitants used this method for providing more privacy.

Generally, the results, which were obtained from the questionnaires, reveal that existing inhabitants, who bought their houses during usage stage mostly, prefer to make the following changes in their houses:

-need to change space organizations of interior spaces (changing wall arrangements dimensions of interior spaces etc …)

-need to change function of spaces (changing location of space)

-need to arrange furniture in different ways

-need to change interior and exterior finishing materials

While, most of the inhabitants, who bought their houses during construction stage only need to rearrange furniture in different ways. In other words, most of them made the above mentioned changes during construction stage based on their needs and tastes by paying extra cost.

Generally, it can be stated that most of existing users, who bought their houses during construction stage had the chance to make some modifications in their houses based on their needs and taste whereas the users who bought their houses during usage stage need to make some modifications in their houses but it can be very time

and cost consuming for them; and this indicates that usage stage is less flexible than design and construction stages.

On the other hand, it can be concluded that changing interior space of the houses, which are more related to functional and cultural flexibility, are mostly preferred by all of the existing inhabitants (both local and international).

4.4. Chapter conclusion

In new housing designs, climate and environmental factors such as topography, direction of sun and wind are not taken into account. While, in rural vernacular architecture of North Cyprus, climate was a key factor in the formation and orientation of houses.

Instead of using environmental friendly materials, reinforced concrete is used together with bricks predominantly in the recent Cypriot architecture as building materials. The skeletal system is used in a restricting design instead of using its potentials as open plan. On the other hand, series of reinforce concrete arches with different styles and dimensions or other traditional elements such as arcaded terraces and balconies are copied as forms in the recent built environment of Cyprus without questioning the concept behind them.

In this chapter, nineteen type of projects and 77 dwellings from recent “build and sell” type of housing projects of North Cyprus were evaluated in terms of flexibility criteria, which were derived from the second chapter.

After evaluating architectural drawings of the case studies according to the flexibility criteria, the following problems as the main problems that restrict users to change their houses were extracted.

-using non-flexible structural method
-defined and labeled functions

-limited dimension of most of the rooms (the dimensions are suitable for only a specific function)
-non-movable brick interior walls
-not locating wet spaces in a specific zone
-restricting furniture arrangements by using fixed cupboards and fixed infrastructure tools
-no adaptability to climate

Then, existing situation of the case studies was evaluated in terms of flexibility in 3 different stages (design, construction and usage) through questionnaire survey to find out how flexible the cases can be in different stages as well as today's needs of the existing inhabitants in terms of flexibility.

After evaluation it was considered that the existing inhabitants (both local and international) mostly prefer to change the interior spaces of their houses and personalize it based on their needs and tastes, instead of external changes that affect the exterior shell of their dwellings. These changes mostly include:

-need to change space organizations of interior spaces (changing wall arrangements dimension of interior spaces etc…),
-need to change function of spaces (changing location of space),
-need to rearrange furniture in different ways,
-need to change interior and exterior finishing materials.

On the other hand, findings revealed that design stage is the most flexible stage among the three stages but most of the houses were bought during construction and usage stages and flexibility is mostly dependent on paying extra cost in these stages. In other words, the people, who bought their houses during construction and usage stages, have to pay higher cost for making modifications in their houses than design stage and this is against flexibility principles. And the problems, which were extracted from evaluating architectural drawings of the case studies, can be the main

reasons that restrict existing users to make some modifications in their houses with minimum payments or without paying any extra cost.

This is the responsibility of designers to provide a more flexible environment that allows users to make modifications based on their needs and tastes through removing the mentioned problems and proposing and applying some flexible strategies in design stage.

It can be concluded that unlike vernacular architecture, flexibility is not considered as an axiom in recent mass housing design in North Cyprus especially in "build and sell" type of housing projects. Doubtlessly, the past experiences suitably respond to the cultural and environmental needs of the context so designers can learn from vernacular architecture and apply its notions of flexibility in recent "build and sell" type of housing design for having more flexible dwellings

In the following chapter, some recommendations will be proposed for improving flexibility in recent "build and sell" type of housing projects of North Cyprus through applying notions of flexibility of its vernacular architecture.

Chapter 5

CONCLUSION AND RECOMMENDATIONS

The main purpose of this study is to evaluate notions of flexibility in recent "build and sell" type of housing projects in North Cyprus through learning from her rural vernacular architecture.

In this respect, through reviewing the theoretical background, the criteria for evaluating flexibility were extracted and summarized in an evaluation table. According to the theoretical background, flexibility was classified into three main groups in this study: structural, functional and cultural flexibility. Each group covers some notions as well. Functional and cultural flexibility are more related to movable parts of the dwellings, while structural flexibility can be more related to non-movable components of the dwellings.

In the next stage, after investigating flexibility criteria in the rural vernacular houses, it was concluded that vernacular dwellings have limited structural flexibility due to limited access to technology, load bearing wall system and timber roofs. Although structural flexibility was limited; functional and cultural flexibility was provided due to nonlabeled spaces, appropriate space dimensions, leaving the interior free from any constructional element and the 'open system' of the courtyard as a potential for 'infill'.

The following parameters are the notions of flexibility, which were extracted from investigation of rural vernacular houses:

- Multi-functionality

- Individuality
-Convertibility
-Modularity
-open plan system (courtyard)
-adaptability to climate
-possibility of horizontal and linear extension and division in both building and Component / site scale

After extracting notions of flexibility of rural vernacular architecture, nineteen projects from “build and sell” type of housing projects were evaluated based on the flexibility criteria, which were extracted from the theoretical background. The evaluation was based on two methods.

First, evaluating the cases form architectural point of view through analyzing the architectural drawings to find out if the selected dwellings have potential for long term flexibility or not.

After evaluation, it was revealed that legal limitations and limited land area may restrict users to make some exterior changes on the external shell of their dwellings such as vertical or horizontal extension, changing the facades, changing the size and location of the openings and etc, while it is possible to change the interior spaces of the houses without any legal limitation. Through analyzing the architectural drawings, the following problems were extracted as the main problems that restrict users to change their houses, especially the interior spaces, based on their changing needs and tastes over the time.

- using non-flexible structural method,
-defined and labeled functions,
-limited dimension of most of the rooms (the dimensions are suitable for only a Specific function),
-non-movable brick interior walls,
-not locating wet spaces in a specific zone,

-restricting furniture arrangements by using fixed cupboards and wardrobes.

Then, flexibility was evaluated in 3 different stages of flexibility: design, construction and usage in existing situation through questionnaire survey to find out how flexible the cases can be in different stages as well as today's needs of the existing inhabitants in terms of flexibility.

After evaluation of 77 dwellings from 19 types, it was revealed that among external changes that affect exterior shell of the dwellings, changing the facade finishing material is mostly preferred by most of the inhabitants. On the other hand, findings indicated that the existing inhabitants (both local and international) mostly prefer to change the interior spaces of their houses and personalize them based on their needs and tastes instead of external changes. These modifications mostly include:

-need to change space organizations of interior spaces (changing wall arrangements dimension of interior spaces and …),

-need to change function of spaces (changing location of space),

-need to arrange furniture in different ways,

-need to change interior and exterior finishing materials.

The considerable point was that the people, who bought their houses during construction stage made most of the above mentioned changes in their houses during construction stage while the people, who bought their houses during usage stage need to make the changes in their houses and it can indicate that usage stage is less flexible than construction stage.

In fact, findings revealed that flexibility in design and construction stages was more than usage stage. In other words, during usage stage the case studies may not have enough potential to be adapted to users' needs and tastes and inhabitants have

to pay extra cost for making modifications in their houses. And the problems which were extracted from analysing architectural drawings of the case studies can be the main reasons that restrict existing users to make modifications in their houses with minimum payments or without paying any extra cost.

This is the responsibility of designers to provide a more flexible environment that allows users to make changes based on their needs and tastes through removing the mentioned problems and applying some strategies in design stage.

In this respect, vernacular architecture can be used as a successful model for achieving both long-term and short-term flexibility in recent mass housing design. In fact, designers should try to apply the notions of flexibility of vernacular architecture such as: Multi-functionality, Individuality, Convertibility, Modularity and open plan system in recent mass housing design in a contemporary process with the help of available technologies and tools.

In the following paragraphs, some recommendations will be proposed for improving flexibility in recent "build and sell" type of housing projects of North Cyprus.

-Long–term flexibility can be achieved in dwellings by predicting future changes during design and construction stages. Structural system as a non-movable and permanent part of the building can be important for achieving long term flexibility. Utilizing flexible structure can allow users to make changes in future based on their needs and preferences. In this respect, two flexible structural methods can be proposed for flexible designs:

1. "indeterminate / incomplete buildings" method: in this method permanent elements (supports) which can be listed as "structural elements", "access units" and "servicing" are determined by the designer and the interior is left for the users to fill

in according to their needs and tastes. In fact, in this method, the occupants themselves will be able to decide how to divide the space and live in it, where they will sleep and where they will eat. If the composition of the family changes, the house can be adjusted, and to a certain extent enlarged. The structural skeleton is a half product which can be completed according to different needs. Applying this method in recent mass housing design can allow occupants to take control of their environment according to their changing needs and tastes and as a result, many of the notions of flexibility in vernacular houses can be obtained.

2. “Polyvalent organization”: in this method, that is more determinate than the previous one, the space is generally divided into permanent “modules” with standardized dimensions that are appropriate for diverse functions. The sizes of the modules are standard and fixed in form, but it is possible to join two or more modules together or to divide a module into smaller modules and users can determine, the usage of these modules. In fact, in this method, architects organize the usage of spaces by folding furnishing elements and moving / folding / sliding walls; and occupants are able to define the function of spaces based on their needs and taste; exchange function of spaces with each other based on their changing needs; or change the dimension of spaces by joining two or more modules together or dividing a module into smaller modules.

This method was already utilized in the vernacular architecture of North Cyprus and designers can also apply this method in recent housing design to achieve some of the notions of flexibility of vernacular architecture such as convertibility, individuality, modularity and etc.

As also stated by Bakkaloglu (2006) when structural system is flexible, possibility of having a flexible layout will be higher, so possibility of obtaining functional and

cultural flexibility can be higher as well. Hence, different structural systems such as steel construction that are more flexible can be proposed. If reinforced concrete skeletal system is selected, waffle slabs with invisible beams can be preferred.

- Designing flat roofs also give users opportunity to extend their houses vertically in the future according to their changing wishes and demands

- The openings will be more flexible if they are made of sliding transparent surfaces and controlled by movable shading devices.

-Instead of non-movable brick dividing walls, different types of demountable wall partitions such as sliding panels, folded accordion partitions and folding-up partitions can be utilized as dividers between spaces so users can change the dimension of the rooms based on their needs and tastes. In fact, it gives users opportunity to extend, divide and separate and rejoin the spaces easily.

-Instead of fixed and single-purpose furniture, furnishing for flexible use can be achieved by using furniture as a surface or as a functional unit. They can also be used as a stable or movable / foldable element in the house. The use of movable / foldable furniture, such as a kitchen or a bed utility, is to transform space during day and night according to the needs and demands of the users. On the other hand, furniture can be used as a functional unit that can make rooms appropriate for different functions during night and day. For instance, instead of fixed cupboards and bulky walls in the bedrooms, storage devices as a partition element can be utilized. These partition cupboards could be flexible and movable to be relocated according to the users' needs for permanent and temporary uses. This can also provide more spaces by the cancellation of the partition element easily. Hence, cupboards can be converted to multi-purpose furniture through applying this method that allows

inhabitants to change the room dimensions based on their needs as well as possibility of converting the bedroom space into another function.

As a matter of fact, utilizing both movable partitions and flexible furniture can give users opportunity to control the interior spaces of the houses based on their preferences and needs. Some of the notions of functional and cultural flexibility in the rural vernacular architecture such as: convertibility, multi-functionality, individuality and the ability of separating and rejoining the rooms can be obtained through utilizing both movable partitions and flexible furniture as well.

Generally, it can be stated that it can be possible to obtain functional and cultural flexibility in recent "build and sell" type of housing projects through applying the above mentioned strategies in housing design, In other words, users have possibility of controlling the interior spaces of their houses based on their needs and preferences through utilizing the mentioned strategies. Besides, due to legal limitations and limited land area in modern times, users are restricted to make some exterior changes to their dwellings such as vertical or horizontal extension

- Designers are also expected to consider climate and environmental factors. The houses are expected to be well oriented towards south for controlling the sun; as well as orienting the openings towards prevailing winds; and allowing cross ventilation for providing natural ventilation and removing humidity.

Designing semi-open, semi-closed spaces in a proper direction can be taken into account such as vernacular architecture, where semi-open, semi-closed spaces were utilized as multi-functional transitional spaces between indoor and outdoor spaces. Generally, designing open and semi-open spaces can be considered by architects as an important architectural element in Mediterranean climate as well as in North Cyprus.

-Locating the wet spaces in a specific zone can be a proper technique for leaving the rest free for the users to furnish in, as in vernacular houses of North Cyprus.

Unfortunately, in the contemporary architecture, flexibility is not considered as an axiom during usage stage. New houses are pasted everywhere without showing any consideration to existing context and user expectations. In this respect, as also stated by Dincyurek & Turker (2007), learning from the principles of vernacular architecture and adapt in the notions of flexibility to contemporary houses is vital"(p. for obtaining long-term and short-term flexibility. It is possible to utilize the notions of flexibility of vernacular architecture in recent houses, with cooperation of recent construction techniques and materials parallel to the latest technologies. Architects and design / construction companies are expected to pay more attention to these values while designing new houses to provide cultural sustainability, continuity, environmental appropriateness and user satisfaction.

This study can be used as a background for further researches on the issue of flexibility in housing design. In this sense, further researches on flexibility in housing context or in different functional buildings can investigate other strategies and methods to achieve flexibility. This study can be a departure point for further studies on the functional transformation of existing buildings to residential ones. The potentials of the functional transformations of existing buildings can be explored and new strategies can be developed. Furthermore, sustainability can be included into the discussion of fulfilling the changing needs of users with diverse lifestyles. The notion of sustainability in flexible design approach brings to mind another issue called sustainable communities; designing multi use spaces for people with diverse lifestyles. Therefore, further studies related to flexibility and sustainability can benefit from this study.

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APPENDICES

APPENDIX A: Form of Questionnaires in Design Stage

Design stage

Hello

I am Golshid Gilani.

I am studying master of architecture at EMU University with the ID number of (095316).

I am working on my thesis that is about flexibility in the houses and the following questions are only used for improving my thesis.

Thank you for your help and cooperation.

Best regard,

Golshid Gilani

---

1. Who is your user profile mostly?

- ☐ National users (locals)
- ☐ International users
  - ☐ Turkey
  - ☐ Other countries

2. Do customers contribute during design stage?

☐ Yes ☐ No

3. Since When your consumers can contribute projects during design stage?

☐ Recently ☐ since we have started our business

4. Do customers have possibility of …..

-extending the spaces outside the during design stage? ☐ Yes ☐ No

- changing the façade (size and location of openings) during design stage? ☐ Yes ☐ No

- changing façade finishing materials (paint, covering materials, door and window materials, roof materials)? ☐ Yes ☐ No

- changing the form of roofs during design stage? ☐ Yes ☐ No

- changing the space organizations of interior spaces? (Wall arrangements, dimension of spaces) ☐ Yes ☐ No

- changing the function of spaces? (e. g. locating one bedroom in the ground floor or a sitting room in the first floor)
  - ☐ Yes
  - ☐ No

- changing the closed kitchen into an open kitchen or vice versa?
  - ☐ Yes
  - ☐ No

- changing the place of electricity systems (E.g. TV or telephone sockets) during design stage?
  - ☐ Yes
  - ☐ No

- changing the position of wet spaces by moving the pipe system?
  - ☐ Yes
  - ☐ No

- changing the place of fireplace during design stage?
  - ☐ Yes
  - ☐ No

- changing the finishing materials of the spaces during design stage?
  - ☐ Yes
  - ☐ No

5. Do the costomers have chance to ask for extra facilities?
   - ☐ Yes
     - ☐ Swimming pool
     - ☐ Jacuzzi
     - ☐ Central heating
     - ☐ Satellite
     - ☐ Fireplace
     - ☐ Attic
     - ……
     - ……..
   - ☐ No

APPENDIX B: Form of Questionnaires in Construction Stage

Construction stage

---

1. Do customers contribute during construction stage?

☐ Yes ☐ No

2. Since When your consumers can contribute projects during design stage?

☐ Recently ☐ since we have started our business

3. Do customers have possibility of :

- extending the spaces outside the dwelling during construction stage? ☐ Yes ☐ No

What kinds of difficulties does this change bring?

.....

- changing the façade (size and location of openings) during construction stage? ☐ Yes ☐ No

What kinds of difficulties does this change bring?

.....

- changing façade finishing materials (paint, covering materials, door and window materials, roof materials)? ☐ Yes ☐ No

What kinds of difficulties does this change bring?

.....

- changing the form of roofs during construction stage? ☐ Yes ☐ No

What kinds of difficulties does this change bring?

.....

- changing the space organizations of interior spaces? (Wall arrangements, dimension of spaces) ☐ Yes ☐ No

What kinds of difficulties does this change bring?

.....

- changing the function of spaces? (e. g. locating one bedroom in the ground floor or a sitting room in the first floor) ☐ Yes ☐ No

What kinds of difficulties does this change bring?

.....

- changing the closed kitchen into an open kitchen or vice versa? ☐ Yes ☐ No

What kinds of difficulties does this change bring?

.....

- changing the place of electricity systems(E.g. TV or telephone sockets) during construction stage?

☐ Yes
☐ No

What kinds of difficulties does this change bring?

.....

- changing the position of wet spaces by moving the pipe system?

☐ Yes
☐ No

What kinds of difficulties does this change bring?

.....

- changing the place of fireplace?

☐ Yes
☐ No

What kinds of difficulties does this change bring?

.....

- changing the finishing materials of the spaces during construction stage?

☐ Yes
☐ No

What kinds of difficulties does this change bring?

.....

4. Do the customers have chance to ask for extra facilities?

☐ Yes
☐ No

- ☐ Swimming pool
- ☐ Jacuzzi
- ☐ Central heating
- ☐ Satellite
- ☐ Fireplace
- ☐ Attic

……

……..

APPENDIX C: Form of Questionnaires in Usage Stage

Usage stage

Ben Golshid Gilani, Doğu Akdeniz Üniversitesi, Mimarlık bölümünde Master yapıyorum. Öğrenci numaram 095316.
Master tez konum; Evlerdeki Değişkenlik ile ilgilidir ve aşağıda belirtilen sorular tezimi geliştirmek amacı ile uygulanmıştır.
Yardımlarınız ve desteğiniz için teşekkür ederim.

Saygılar
Golshid Gilani golshid_g1985@yahoo.com

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1. How many users are living in this house?.....

2. Which nationalities are the users?
   - ☐ National users (locals)….number of users……
   - ☐ International users
     - ☐ Turkey.....number of users……
     - ☐ Other countries…….number of users……

3. Are you……?

   - ☐ Owner
   - ☐ tenant

4. In which stage did you buy this house?
   - ☐ Design stage
   - ☐ Construction stage
   - ☐ Usage stage(it was complete)

5. Did you have the chance to contribute in the formation of your house?

   ☐ Yes ☐ design stage ☐ Construction stage ☐ Usage stage ☐ No

5. Do you need to:

- Extend the spaces outside the dwelling?
  ☐ YES
  ☐ No
  ☐ We did it already ☐ design stage ☐ Construction stage ☐ Usage stage

- change the facades of your house? (size and location of openings)
  ☐ YES
  ☐ No
  ☐ We did it already ☐ design stage ☐ Construction stage ☐ Usage stage

-change façade finishing materials (paint, covering materials, door and window materials)?
  ☐ YES
  ☐ No
  ☐ We did it already ☐ design stage ☐ Construction stage ☐ Usage stage

- change the form of roofs?

☐ YES
☐ No
☐ We did it already
  ☐ design stage
  ☐ Construction stage
  ☐ Usage stage

- change the space organization of interior spaces? (E.g. enlarging your living room without changing the façade)

☐ YES
☐ No
☐ We did it already
  ☐ design stage
  ☐ Construction stage
  ☐ Usage stage

- function of spaces? (E.g. locating a sitting room in the first floor of a bedroom in the ground floor

☐ Yes
☐ No
☐ We did it already
  ☐ design stage
  ☐ Construction stage
  ☐ Usage stage

-use a space for different purposes?
If yes, which spaces and which purposes?.....
……..

☐ YES
☐ No

- change your closed kitchen into an open kitchen or vice versa?

☐ YES
☐ No
☐ We did it already
  ☐ design stage
  ☐ Construction stage
  ☐ Usage stage

- change the place of electricity systems (E.g. TV or telephone sockets)

☐ YES
☐ No
☐ We did it already
  ☐ design stage
  ☐ Construction stage
  ☐ Usage stage

- change the place of wet space? (WC, kitchen)

☐ YES
☐ No
☐ We did it already
  ☐ design stage
  ☐ Construction stage
  ☐ Usage stage

- change the place of fireplace?

☐ YES
☐ No
☐ We did it already
  ☐ design stage
  ☐ Construction stage
  ☐ Usage stage

- change the finishing material of the interior spaces?

☐ YES
☐ No
☐ We did it already
  ☐ design stage
  ☐ Construction stage
  ☐ Usage stage

- rearrange your furniture in various ways?

☐ YES
☐ No
☐ We did it already
  ☐ design stage
  ☐ Construction stage
  ☐ Usage stage

6. Do you have enough privacy

- related to your openings? ☐ YES ☐ No

-related to your garden walls? ☐ YES ☐ No

-related to the interior layout? ☐ YES ☐ No

21. Do you have enough spaces in your home for helding a ceremony such as birthday party or..?

☐ Yes ☐ No

If No, do you need it?

☐ Yes ☐ No

22. Are there any users with physical movement restrictions in your house?

☐ Yes ☐ No

If yes, do they have any trouble with……?

☐ Stairs ☐ wet spaces

☐ Entrance ☐ level differences in your house

☐ Kitchen height

Table.4.26. inhabitants' needs for making interior changes that have no effect on external shell of the dwellings during usage stage

Table.4.15. Summary of Notions of Structural Flexibility in 19 selected projects

								Otuken project						Bogaz Cove Project		pearl village Project		Mutluyaka Project			Dovec Project			Salamis Project		
								A	B	C	D	E	F	1	2	silver	golden	A	B	C	A	B	C	A	B	C
Non-Movable Parts: (Structure Skin & Core)	**Spatial/ Structural Flexibility**	**Extendibility and division**	According to Scale and Direction	Component scale	horizontal	Extension	It can be restricted due to legal limitation and building codes, non-flexible structural organization and limited land area	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-
						division	Legal restriction and building codes, non-flexible structural organization restricted division	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
				Building scale	horizontal	extension	Due to non-flexible structural organization and non-movable brick dividing walls it is restricted	✓	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-
						division	Limited space dimension with irregular structural organization of spaces restricted it.	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-
					Vertical	extension	No possibility due to inclined roofs and legal restrictions	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
						Division	No possibility due to Limited heights of spaces	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
			According to form	Radial expansion	Horizontal	it is not considered in the evaluation because this type of expansion is not possible in this type of buildings																				
					Vertical																					
				Linear expansion	Horizontal	legal limitation and building codes, non-flexible structural organization, non-movable brick dividing walls & limited land area restricted horizontal expansion and division		✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-
					Vertical	No possibility of vertical expansion and division due to Legal limitations, inclined roofs and limited heights of spaces		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
				Clustered expansion	Horizontal	Legal limitation and building codes, non-flexible structural organization, and limited land area restricted it		✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-
					Vertical	Legal limitations, inclined roofs and limited heights of spaces restricted vertical expansion & division		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		structural methods	Incomplete/ indeterminate buildings: permanent elements, which can be listed as " structural elements", "access units" and "Servicing". The rest is left as a generic space			Designers did not leave the interior space for the users to fill in, based on their needs and taste .All spaces are determined and labeled.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
			standardized modularization permanent "modules" with standardized dimensions appropriate for diverse functions.			No permanent modules with standardized dimensions which can be utilized for different functions except type D in Otuken project		–	–	–	✓	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Forms of roofs	Flexible (Flat roof) or non-flexible			no flat roofs were constructed Constructing inclined roofs due to demands of optimum users		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Flexible façade				Fixed facades without any facility for achieving flexibility. Openings are limited and predicted and no sun controls were used.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

					Otuken project						Bogaz Cove Project		pearl village Project		Mutluyaka Project			Dovec Project			Salamis Project		
Table.4.18. summary of Notions of functional flexibility in 19 selected projects					A	B	C	D	E	F	1	2	silver	golden	A	B	C	A	B	C	A	B	C
Movable Parts: (Layout & Furniture)	Functional flexibility	Versatility: spatial multi use with minor structural modification		It can be achieved in some case studies by removing non-load bearing dividing walls and utilizing movable partitions instead of them in some spaces.	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	–	–	✓-	✓	✓	–	–			–	✓-
		Convertibility:	Ability to permanently convert space from function to another without any structural modification	Due to labeled and fixed functions, in most of the cases it cannot be possible to permanently convert a function into another function	–	–	–	–	–	–	–	✓-	✓-	✓-	✓-	–	–	–	–		–	–	–
			Ability to exchange or interchange space functions without any structural modifications	Possibility of exchanging space functions with each other only in a few spaces in the cases , because of fixed and defined functions, as well as limitation in dimension of most of the spaces	✓-	✓-	✓-	✓-	✓-	✓-	–	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	–	–	–
		Multi-functionality: the ability of having different function at the same time, at the same place		No multi-functional spaces due to fixed and defined functions, dimension of most of the spaces is suitable for a specific function , Fixed cupboards	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
				Just living room has the potential of having different functions at the same time	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		the ability to separate and rejoin the rooms and units in terms of movable partitions		Because of non-movable brick dividing walls, no possibility to separate and rejoin the rooms based on users' needs…Only, possibility of dividing one space into sub-spaces by using movable partitions but with considering the limitation in rooms' size.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Flexible furniture: The ability to rearrange furniture		Possibility of arranging furniture in different ways due to non-fixed furniture especially in living room,	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
				Fixed and defined functions , Dimensions of most of the spaces are suitable for a specific function as well as fixed cupboards and wardrobes may restrict users to arrange furniture in various way	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	–	✓-	✓-	✓-
		The ability to place wet spaces within specific zones but not to be permanently , fixed, freedom of main space as generic space		Wet spaces are fixed and permanent in all case studies and they were not located in a specific zone	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Adaptable to climate		Using environmentally sensitive materials: in all cases, using contemporary materials without environmental precautions in both shell and interior spaces	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
				Orientation towards the Sun: Orientation of houses is based on position and entrance direction of the land instead of being located according to the north-south direction to take advantages of the sun	–	–	–	–	–	–	–	–	✓	–	–	–	–	–	–	–	–	–	–
				Providing natural ventilation: No strategies for natural ventilation in all cases	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
				Utilizing external Sun control devices: only interior curtains can be utilized for controlling the sun.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Adaptable to disabled		locating private zone in the upper floor may not be suitable for old age or disabled people	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table.4.19. summary of Notions of cultural flexibility in 19 selected projects					Otuken project						Bogaz Cove Project		Pearl Village Project		Mutluyaka Project			Dovec Project			Salamis Project		
					A	B	C	D	E	F	1	2	silver	golden	A	B	C	A	B	C	A	B	C
Character (identical) flexibility	Individuality:		-Labeled spaces,		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
			-Dimension of most of the spaces is suitable for a specific function,		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
			-Non movable brick interior walls		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
			Furniture is not fixed and the style of furniture is selected by the users		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Improving privacy	exterior privacy: between public and semi-private areas	Due to regulations, maximum height of the walls cannot be higher than 1.20cm so terrace and yard that have direct physical and visual contact with the streets. Although users can use plant fence for providing more privacy	Physical privacy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
				Visual privacy	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-
		Interior privacy: Boundaries between semi public and private areas	No direct physical access to the interior spaces due to the entrance door. Direct visual access to a few parts of interior spaces through windows due to direct physical and visual access to the entrance terrace. Separating interior space into private and public area is another method for providing more interior privacy in all cases.	Physical privacy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
				Visual privacy	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-
	Cultural identity		No fixed cultural symbols but a specific architectural style		✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-
			- Only furniture is not fixed but there are some limitations in furniture arrangement because function of spaces are defined, dimension of most of the spaces is suitable for a specific function and existing fixed cupboards		✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-
	Adaptable to different users		Both interior and exterior Finishing material can be changed whereas openings or façade style is fixed. Space organization of interior spaces is fixed		✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-	✓-