TRADITIONAL VALUES VERSUS MODERN CONVENIENCES: AN ANALYSIS OF TRADITIONAL COURTYARD AND CONTEMPORARY HOUSE DESIGN TRENDS IN LAHORE

*Fariha Tahseen**

ABSTRACT

Courtyard house, as one of oldest forms of housing tradition, is a remarkable form of residential architecture due to its attributes of naturally climate controlled spaces, spaces of peace and seclusion and as a central nucleus (a social space) around which domestic life revolves. In Lahore, visible transformation of housing trends has continued after independence (1947) with several emerging issues of growing population, rapid densification and exponentially rising land value. By 1960s and 70s, bungalow style of housing with a flavor of modernism inspired middle and upper middle income people to adopt modern life style. All these facts impelled courtyard style of housing into complete disuse. Researchers and designers are certainly aware of the need to cope with local climatic and energy crisis in residential architecture to enhance physical comfort of inhabitants, which needs to analyze design and performance patterns of traditional courtyard houses, in comparison to modern detached houses. This research paper, through analysis of two local case studies in Lahore, explores how a courtyard house can be revived with minimal interventions to achieve climatically responsive houses that would address adequately the climatic concerns. Findings on evolution and aspects of housing typologies (courtyard house, detached and semidetached houses), followed by comparative case studies analysis, and field investigation through questionnaire and interviews supplement research methodology for this paper.

Keywords: Courtyard house, Detached house, Climatic Responsiveness, Physical comfort, Design and Performance patterns, Lahore.

INTRODUCTION

Courtyards as private open spaces have been in use in residential architecture for almost as long as people have lived in constructed dwellings. The courtyard housing carries the potential to solve many climatic and social issues of housing. The concept of courtyards originated in Egypt and was later passed on to Mesopotamians, the Islamic world and was adopted all across the globe. However, after the advent of industrial revolution and flourishing of the British Raj in the sub-continent, an evident change in architecture and life style of people was witnessed because of the invention of modern commodities, like heating and cooling appliances, as a result of which the courtyard houses were replaced with detached and semidetached houses. Furthermore, the British influence, led by inspiration from British Colonial architecture and a desire for adoption of modern lifestyle influenced from the West, replaced traditional courtyard houses. More reasons behind the replacement of the traditional courtyard houses with the detached and semidetached housing typologies are the population growth and environmental concerns. This paper is structured by narrating aspects and general perspectives of courtyard houses and detached houses, followed by a generic comparison, in the context of Lahore. An analysis of a contemporary traditional house and a modern detached house in Lahore with a description of style of prevailing housing trends informs the paper.

ATTRIBUTES OF TRADITIONAL COURTYARD HOUSES

The initial logic behind the evolution of the layout of a courtyard house was to achieve an enclosed territory which was protected from invasion by humans and animals. With the progress of time, its plan evolved to achieve climatic and functional efficiencies. Thus, the essence of the courtyard house is embedded in fusion of environmental and climatic aspects, together with social and cultural values, which is perhaps the main reason behind its long survival as a house type.

* Fariha Tahseen, Lecturer, Departmen of Architecture and Planning, NED University of Engineering and Technology, Karachi, Pakistan. Email correspondance: fariha_tahseen@yahoo.com

Like other regions of the world, in the sub-continent, the layout pattern of the courtyard house was influenced by regional variations. The type predominantly evolved in the Mughal Period (late sixteenth to early eighteenth centuries) and later during the British Raj (from late eighteenth to early twentieth centuries). The courtyard houses of these eras were adjoining each other, with no compulsory open spaces around them. They opened directly onto the streets and worked in harmony with the street profile and the social life. Visitors had to stop at the entrance threshold, where there was a sitting space known as '*baithak*'. The courtyards were usually square or rectangular in shape, with covered corridors or galleries around them, that worked as circulation and buffer spaces for privacy. The size of the courtyards and the height of the walls around regulated the climate of the indoor spaces, as narrowness maintained shade in summers but still it had to be wide enough to receive the winter sun. Functions of the rooms (except the kitchen) were not fixed, but their occupancy depended on thermal comforts during summers and winters. Randhawa (1999) states that the physical design and existence of typically planned courtyard structures complemented the society of its times and the local climate.

Researchers (Sharif, Zain & Surat, 2010; Edward et. al., 2006; Reynold, 2002) agree that sustainable developments are self-generating in terms of energy consumption, and keep renewing and replenishing themselves for future generation as well. Use of local material, reduction in energy consumption and integration of socio-cultural values contribute effectively to build a sustainable house. 'Traditional buildings are a product of an age long tested and trusted reaction to environmental realities. This set of structures deserves conservation in their efficiency, low-tech solutions and popular acceptability among users' (Sharif, Zain & Surat, 2010: 4029). Edward et. al. (2006) agree that courtyard houses are responsive to low rise high density urban housing, and offer an appropriate form of housing within contemporary mixed use sustainable urban development. However, Amadouni (1994) contradicts this notion to some extent by stating that a settlement with courtyard housing results in compact urban scheme, which contributes to only physical sustainability, but to achieve comprehensive sustainability in terms of socio-cultural stability this concept of courtyard housing as compact urban scheme is not sufficient.

A central position for a courtyard is allocated in a house since it functions as climate modifier. Likewise, several authors acknowledge climatic benefits of a courtyard house. Donham (1960) mentions that a small courtyard is an excellent thermal regulator in many ways. Olgay (1963), Fathy (1986) and Donham (1960) recommend small courtyards for providing satisfactory indoor environmental conditions for hot and dry climates. Rapoport (1969) also supports the fact by stating that a courtyard house, as a traditional house type, has many advantages as being climatically responsive. Edward et. al. (2006) refer to a courtyard house as being widely accepted as a thermal moderator in hot and dry climates. They do this after examining various case studies of courtyard houses across the world, and identify several ways in which a centrally enclosed, open-to-sky courtyard can effectively reduce day time temperature by promoting air circulation and increasing the humidity content when provided with a water body or fountain.

The theories, concepts, ideas and philosophy behind significance of courtyard housing focus on aspects of centrality, enclosure, origin and unity as historically courtyards have been used for many purposes including relaxing, working, playing, sleeping, cooking, celebrations and even as places for keeping animals. Extensive literature has been produced on courtyard housing, its features and many aspects as it is a purposely built housing typology with diverse and peculiar features that have lead many researchers to analyze it.

ASPECTS OF MODERN DETACHED/ SEMI DETACHED HOUSES

The origin of a detached house as a 'bungalow' or a 'villa' can be traced to Roman times, when the extroverted nature of a villa was supposed to show off wealth and status of the inhabitants. 'Basically, the modern non-courtyard house is a rectangular prism (or an agglomeration of rectangular prism) placed at random on the building plot with a garden at the back and at the front, along three sides or all the way round; it is in effect 'a box in the garden'' (Al Azzawi, 1984: 35). In the sub-continent, the British Raj was the pioneering spirit of introducing the villa/bungalow style of house. Randhawa (1999) states that the courtyard style of housing as inappropriate for the British sensibilities of privacy. Classical western models were inappropriate too, due to letting in undesirable light and heat. With considerable experimentation, they derived at the bungalow style, which was a cross between the English cottage or modified Palladian villa, with a corridor around the house, instead of a courtyard within. Incorporating verandahs served as buffer space for preventing direct sunlight from reaching rooms. This structure was raised on a plinth and had a verandah as the entrance foyer, which acted as a transition space within the bungalow. All bedrooms, with attached bath, surrounded the central

hall. Every room was purposely functional. Kitchen at rare side of the bungalow was connected with a corridor, which had direct access from the servant quarter.

The detached villa displayed a leisurely and ostentatious lifestyle, as narrated by Al-Azzawi, 'Modern non-courtyard houses satisfy a personal and social need, namely, the need for a symbol of social success and social status' (Al-Azzawi, 1984: 278). A house front garden was supposed to be a status symbol, to impress visitors and passerby. Al Azzawi further states in his analysis of the detached modern house, 'there is a tendency nowadays to replace the outer boundary wall by a metal rail which invites overlooking by passer-by. The reason for this is to show the front elevation of the house to the passer-by; this is yet another manifestation of the status symbol' (Al Azzawi, 1984: 251). Besides raising social and wealth status from a modern detached house, another imperative to achieve in the villa type of house is an enclosure which is self-contained and maintains its own indoor climate by active strategies of cooling.

A detached enclosed modern house is advantageous in terms of safety and as an enclosed territory which can avoid dust accumulation, and for avoiding cold winds during winter season. Edward et. al. (2006) states that modern self-contained housing type has an environment which "is mainly controlled by mechanical means (air-conditioning, etc) with the inevitable consequence of isolating the interior world from the exterior. This is what is called the 'exclusive' model, because the form of the building and the nature of the envelope encourage isolation' (Edward et. al., 2006: 224). In a research Ron Apelt et.al. (2003) find that greenhouse gas emissions responsible for global warming are attributed to the electrical appliances in residential operations. It is also argued that western models of housing that are promoting the use of these appliances are less concerned with the local climate, building methods and cultural traditions. Building regulations and planning laws are also adopted and modeled on European practice. 'In such buildings people are isolated from their surroundings, becoming physically and socially separate. Cheap energy sustains such practice but, as the lens of history shows, it is a form of urbanism far removed from the carrying capacity of local resources and local customs' (Edward et. al., 2006: 224).

The design pattern of a house can contribute effectively, creating a microclimate, by taking advantage of beneficial aspects of climate and avoiding the unfavorable aspects. Understanding the needs of a house with respect to climate, orientation, form and layout to cope with the local climate and decrease dependence on artificial means of ventilation should be priority for designers. It can be argued that if buildings do not take into account climatic factors then the resulting conditions will make the demand for air-conditioning perfectly reasonable. With this premise the paper moves onto the introduction of the research methodology and then onto describing the findings and analysis of the research.

RESEARCH METHODOLOGY

The key objective of this study is to analyze housing patterns and design for improved physical performance and thermal comfort of inhabitants with a concern for local climate, confined energy resources and to promote regional identity and sustainability. A typological analysis of a contemporary traditional house and a modern detached house in Lahore was conducted as a description of style of prevailing housing trends. This analysis was based on plan configuration, use of outdoor spaces, façade treatment and urban configuration. Furthermore, a survey was designed for data to be collected from forty seven residents to inquire about their preference of housing style, climatic responsiveness of their houses and the level of satisfaction with indoor thermal comfort and ease of performing daily tasks. This survey was supported by qualitative interviews of residents of surveyed houses and two architects (one designing modern houses while the other designing traditional courtyard houses in Lahore). These findings enabled the researcher to arrive at conclusions with several recommendations.

LINK BEHIND RISING TEMPERATURES AND HOUSE DESIGN

Lahore features hot semi-arid climate that comprises of long and intense hot summers, an unpredictable warm and dry winter, dust storm and monsoon. Sun, wind and humidity or precepitation are the three primary forces determining the climate of a region. However, the sun is seen to be the most dominant. A research study conducted by Sadiq (2010) calculated the mean maximum and minimum temperature for Lahore over the period 1961-2007, which showed an increasing trend in temperature with rates 0.025C and 0.054C per year (Figure 1). One of the major reason behind production of heat in the urban areas is the heat released from buildings due to machinery used in buildings, lack of greenery and vegetation, traffic and air pollution, industrial wastes, insensitive use of material and building techniques that add to rise in temperature.

According to statistical data compiled for a research study about passive and low energy architecture in Lahore, the energy consumption of residential buildings in Pakistan

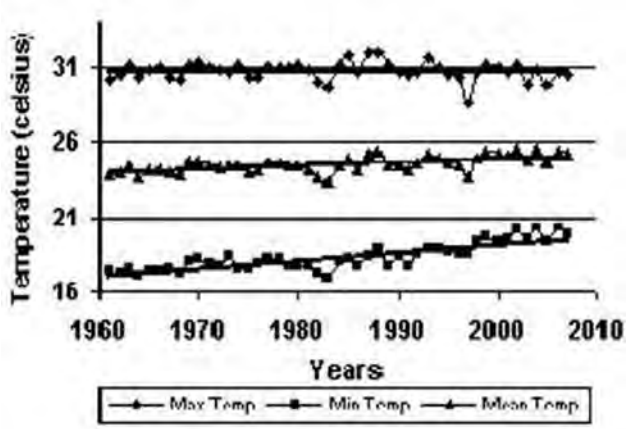

Figure-1: Tmax, Tmin, Tmean of Lahore.
Source: Government of Pakistan Finance Division, 2020.

Appliance	Percent of Households Owning 2003/04	Percent of Households Owning 2007/08	Increase (in Percentage Points)
Air Cooler or Fan	83.3	86.4	3.1
Sweing or Knitting Machine	52.7	72.7	20
Television	41.6	63.2	21.6
Washing Machine or Dryer	37.8	48.8	11
Water Pump	31.7	54.5	22.8
Refrigeratior or Freezer	27.9	40.3	12.4
Radio	13.4	40.0	26.6
Air Conditioner	2.8	6.6	3.8
Personal Computer	2.7	8.5	5.8
Cooking Range of Microwave	2.5	6.0	3.5

Figure-2: Appliance Ownership in Punjab.
Source: Government of Pakistan Finance Division, 2020.

Figure-3: Wall Creepers Covering Exterior Facade.
Source: www.googleimages.com

Figure-4: Living Room.
Source: www.googleimages.com

accounts for almost forty percent of the electricity generated and the consumption rate is increasing at fourteen percent per year. Figure 2 shows that appliance ownership and usage (especially air conditioners) has grown over the years in Pakistan, resulting in increase in energy consumption and rise in overall surrounding temperature.

RESIDENTIAL TRENDS IN LAHORE: A TYPOLOGICAL ANALYSIS

Before establishing a comparative typological analysis, it is required to identify and examine an example of a modern traditional house parallel to an example of a typical modern detached house in Lahore, to describe the aspects of both housing typologies. The parameters to examine the case studies are micro-climate, utilitarian facilities, form of houses and how they merge with surrounding environments, planning and use of materials.

Case study of a Contemporary Traditional House in Lahore

Traditional architecture is characterized by use of local materials, rich design vocabulary, construction techniques and a concern for natural light, air circulation and integrated vegetation. A traditional house designed by an eminent Architect Kamil Khan Mumtaz (expert in traditional architectural practices) was taken as a case study to analyse a traditional house based on the above analytical parameters.

This house creates an indoor versus outdoor visual connection and also maintains a close relationship with nature. The central living/ lounge space is airy, well ventilated and adorned with an aura of grandeur (Figures 3-4). The high vaulted ceiling of the lounge with floral motifs (Figure 5), a feature of Islamic architecture, is not only visually appealing but also regulates the indoor temperature, as it has been

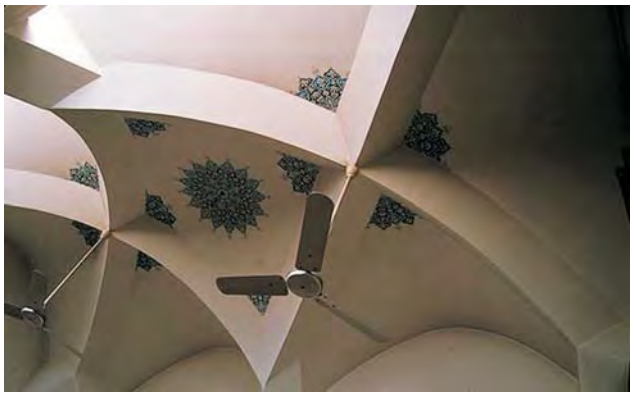

Figure-5: Vault structure and floral patterns on ceiling.
Source: www.googleimages.com

Figure-6: Aerial View of Wind Catcher.
Source: www.googleimages.com

established that for every one foot (30 cm) rise in the ceiling height (besides standard height) reduction in temperature by three degrees centigrade can be achieved.

The use of facing bricks on entire façade enhances the indoor thermal performance, as bricks have adequate time lag which result in blocking summer sun radiation. Good insulation value of bricks help in avoiding indoor heat loss during winters. The use of traditional porous brick paving, when sprinkled with water before mid-day or during the afternoon, absorbs and retains some water, which helps in reducing floor temperatures and also helps in creating cooling effect by evaporative cooling.

The vault structure at the building roof top is designed purposely as a wind catcher (Figures 6-7) A central open-to-sky hexagonal courtyard with Palm trees, catches natural day light and creates a passage for air circulation (Figure 8). Plantation in the courtyard obstructs direct sun glare and provides shading, which helps in reducing ground surface temperature. The veranda provides shade for doors and windows from direct sun glare. The outer façade of the

Figure-7: Wind Catchers Inside the House.
Source: www.googleimages.com

Figure-8: Central Courtyard with Palm Trees.
Source: www.googleimages.com

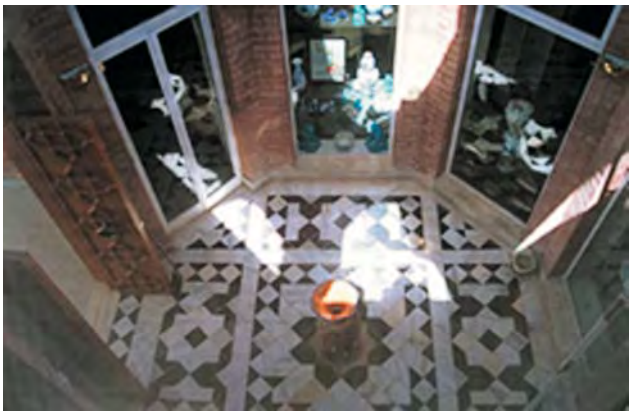

Figure-9: Central Space for Natural Light Provision.
Source: www.googleimages.com

house is quite simple yet elegant, not having excessive window openings. The overall thermal comfort of the house is enhanced by a dramatic play of shades and shadows.

Case Study of a Modern Detached House in Lahore

A modern detached house is characterized by individual expression, and has an isolated structure standing on the ground, with compulsory open space all around or at least along two or three sides. A typical modern house in Lahore is selected to examine typical aspects of a modern detached house. Set back requirements allow every ten marla (300 square yards) or bigger house to have a small garden in the front and a car porch area under the front terrace. Setbacks are also required to be provided at either side of the built form and at back rear side of the house too. It is generally considered prestigious to have a well maintained front lawn and a posh interior environment (Figures 10-11).

The front lawn is used in early morning and late evening. Bedrooms of the first floor and the drawing or dining rooms have windows looking into the front lawn. Therefore, only two or three rooms of the house can enjoy the view from the garden. During peak hours of the summer season, heavy curtains or blinds are used to cover windows to avoid excessive sun glare and heat (Figures 12).

A modern house is generally enclosed for security purposes and for protection from unwanted sun, wind, rain, dust and insects. Indoor thermal comfort is preferred to be achieved by mechanical air conditioning systems. This promotes the use of heavy curtains, rugs, furniture and variety of lights that enhance the ambient environment but adds to the air conditioning loads. In summer months, the inside-outside visual space sequence is not often experienced because of the discomforting glare from outside, which obliges the inhabitants to keep curtains drawn for a considerable number of hours during the day.

TYPOLOGICAL ANALYSIS

Plan Configurations

Evidences of centrally designed courtyard housing can be found in the historical 'walled city' of Lahore. These houses were built side by side with common walls, having narrow frontages and a central courtyard surrounded by rooms (Figure 13). Such houses have almost disappeared from the urban context of Lahore now. However, a survey of contemporary traditional houses in Lahore revealed that the layout plans do not have a central courtyard space surrounding by rooms, but the courtyard space has shifted from the centre

Figure-10: Front View of Modern House.

Figure-11: Lawn in the Front Portion of the House.

Figure-12: View of the Dining Room.

position to being a pocket space on the right or left side of the plot (Figure 14). This space is popularly known as the '*patio'*. Apparently this space tends to function like a courtyard as in the older traditional houses. The functional relationship of this outdoor space is to give visual aesthetics to the lounge area, bedroom and an outdoor link for kitchen ventilation. In a modern detached house, at times this side space is designed as a patio for outdoor purposes, like washing and drying. The location of this space is within the compulsory open spaces of the plot.

The survey analysis also demonstrated that the layout plan of a traditional house and a modern detached house were almost the same, (due to the narrow frontage and elongated shape of the plot) except for the provision of the courtyard or a patio space in the plot's compulsory open space area.

Over time, with the evolution of the house as a typology, the central lounge space has adapted many socio-cultural features of the courtyard, such as family gathering/ relaxing and acting as a connecting space to the rest of the rooms in the house. The outdoor open to sky space has been converted into an enclosed indoor space with family activity centered around modern appliances, such as the television. This space is usually equipped with an air conditioner to achieve a comfortable indoor environment. The central lounge space surrounds the bedrooms, kitchen, dining room, outdoor patio or courtyard and contains a staircase lobby for assessing the first floor. The lounge space of many of these houses is a double height space with large size windows providing visual connection with the outdoor patio or garden. The first floor of the house has bedrooms with attached bathrooms, a store and at times a study room and also an access to a front terrace or balcony, which is not often used, because of privacy constraints, but it is provided for visual aesthetics.

Use of Outdoor Spaces

In the traditional housing of Punjab there were generally typical courtyard houses with courtyards located on the ground level, which were completely open to the sky, and had adjoining rooms opening directly onto them. Special consideration for plantations, water fountains and shading was given as most of the times (morning, evening, nights) were spent in these courtyards and many activities such as cooking, washing clothes, drying, eating, sleeping, children playing, family gathering used to take place in the courtyard. In the rural areas courtyard houses had mud finishes and in urban houses plaster, paint finish and bricks were used for external finishes with beautiful patterns and ornamentations on the façade of houses for the elite.

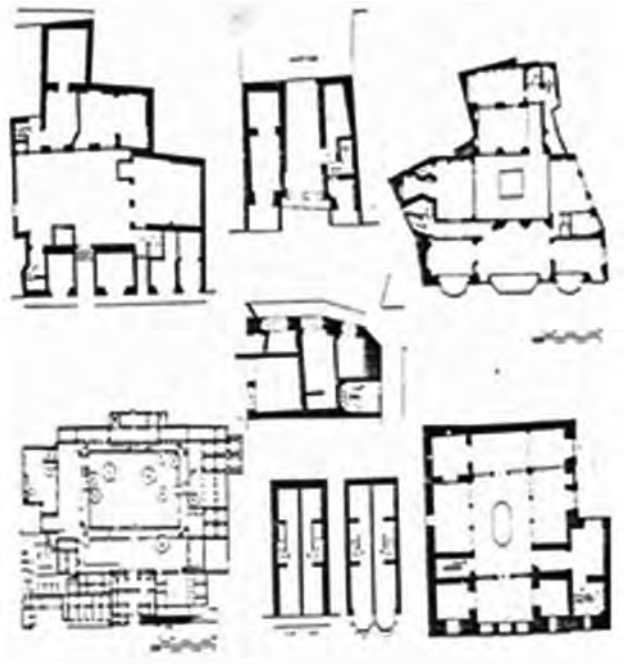

Figure-13: Layout Plans of Traditional Courtyard Houses in Lahore.

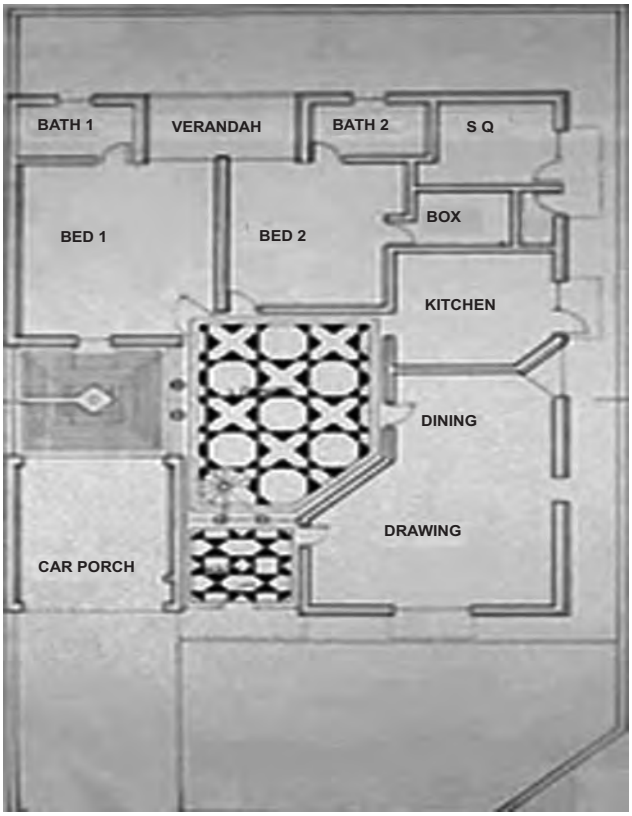

Figure-14: Layout Plans of Traditional Patio Houses.

In contemporary traditional housing, because of the limited plot size and setback requirements, the courtyard space have shifted towards plot side boundary wall. The same features of brick and terracotta pavements, central fountain, plantations, bird cages, dramatic play of shades and shadows are incorporated to maintain an introverted character with ambience and aesthetics, as in traditional courtyard houses. However, if central courtyards are provided in contemporary houses they only fulfil climatic and aesthetics purposes, they are not used as multi-activity areas for daily house hold activities as in traditional courtyard houses.

A contemporary modern house follows the imperatives behind a detached villa, as a symbol of social status and prestige holding extraverted character. Some of the constrictions that need to be addressed are limited plot size, need for a car park and setback requirements. A front lawn is preferred which needs to be maintained for creating a pleasant environment. Since the lawn is a semi-private domain, therefore it cannot be used for household activities like washing and drying clothes, or for eating and sleeping outside.

Façade Treatment

The choice of materials for façade finishes significantly distinguishes traditional houses from modern houses. The traditional house use indigenous material such as fair faced brick, lime plaster, stucco, terracotta paving, wood and avoids excessive window openings or glass treatment. Whereas a modern house has plaster and paint finishes, and is often cladded in tiles. Provision of large sized windows on the front façade is a significant feature of a modern house. This however, adds to the air conditioning requirements and reflective glazing with polyurethane sheets are often used for insulation purposes.

An interesting feature of contemporary traditional houses is their repetition of design features from historical traditional houses. A contemporary traditional house may at times incorporate design features and elements with intricate detailing to reflect aesthetics of traditional architecture within contemporary forms. Some of these elements are used in terraces, arcades, overhangs and galleries. Some of these ornamental features (like trellises) help regulate microclimate by shading walls and windows and also facilitate air circulation (Figure 15).

Urban Configuration

In historical areas of Lahore, where traditional courtyard houses exist, street layout are quite compact, with the streets being as narrow as six to ten feet. Although this street works for thermal efficiency, as a microclimate is created and houses are shaded from direct sun exposure by neighbouring walls, yet the congestion and resultant infrastructure services provision is problematic. The high density and street layouts however, promote and support pedestrian friendly activity in the neighbourhood. In comparison, as per the byelaws, the street widths in new neighbourhoods vary from twenty-four to thirty feet, which facilitates the movement of cars, but does not promote walking activities. It also exposes houses to direct sun light exposure, and results in dependence on air conditioners.

COMPARATIVE ANALYSIS

Based on the literature review and case studies documentation and analysis, the following points can be highlighted:

1. One of the most inspirational qualities of courtyard houses is its local character. 'Careful studies of many other 'ethnic' courtyards worldwide would reveal unique and personable characteristics all their own, and would add to the richness of worldwide 'courtyard culture' (Amadouni, 1994: 45). A modern detached house possesses diversity in features, materials and design aspects, which at times, articulates individuality but leads into typological ambiguities and raises questions about aspects of regional identity and local character.

Figure-15: Balcony designed as part of front facade of a contemporary housese.

2. In a detached house compulsory open space has to be given all around the built form, which compromises the quality of the open space. In a courtyard house the open space can be combined into the courtyard, especially if the house is being designed in a location where byelaws are not very strict, thus a courtyard house is more efficient in terms of planning.

3. A courtyard house has various habitable rooms suitable for different seasons and hours of the day, however a modern detached house lacks this aspect. In courtyard houses, traditionally rooms were not specified by function, as the courtyard is a multifunctional space accommodating various activities, with other rooms considered for diurnal variations. On the other hand, in detached houses, as an inspiration of bungalow style of housing, all rooms have a fixed function with no multifunctional space.

4.The courtyard house is the most suitable typology for non-conventional energy conservation and efficiency, which is achieved through reduced energy demand and by promotion of passive heating and cooling. In a research study conducted by Amadouni (1994), it is concluded that it is preferred to have substantial energy savings based on house form and nestling configuration and breathe healthy air, rather than super insulate buildings and suffer the sick building syndrome. He also argues that 'closely nestled housing typologies, such as courtyard or row housing, are more energy efficient than detached housing, for the sole fact that the additional exposed surfaces of the latter require much more energy to heat in winter than the others' (Amadouni, 1990: 56).

5. A courtyard house has windows which open inside the courtyard, therefore, they can be left open during summer nights for air circulation and cross ventilation. In a detached house windows are facing the front lawn or other sides, which cannot be opened during summer nights for security and privacy reasons.

6. A courtyard house is designed primarily to cope with hot and dry climate due to its open air design and planning, which is good for summers. But its design is not capable to block cold winds. However, an enclosed modern detached house if not efficient in keeping the summer heat away or addressing the extreme cold weather, and is dependent on artificial means of ventilation in the Pakistani context.

SURVEY FINDINGS

A survey with eighty residents (living in forty-seven different houses) was conducted to explore residents' preference of housing style in Lahore, climatic responsiveness of their existing dwellings and their level of satisfaction with indoor thermal comfort. Among these twenty-two houses were traditional courtyard houses in Lahore, and rest were detached or semi-detached houses in Lahore.

The findings were tabulated on a Bedford scale for level of thermal comfort or discomfort in houses. In responses received, there was a marked difference in thermal comfort levels of both housing typologies. In traditional houses, comfort levels varied from 'comfortable' to 'too cool', however few residents were quite unsatisfied. Whereas in modern houses people marked 'comfortable' to 'too warm' range. Here a marked deviation was observed, since one resident marked much too cool (Figure 16-17). The survey analysis also demonstrated a higher percentage of use of air conditioners for cooling in modern houses as compared to traditional houses (Figure 18). There was a marked difference in satisfaction of thermal comfort level for residents of traditional houses as compared to modern houses. Another considerable finding of this survey was that sixty five percent

Mach too Cool -3	Too Cool -2	Comfortable Cool -1	Comfortable 0	Comfortable warm 1	Too warm 2	Mach too warm 3

Figure-16: Bedford Scale of Thermal Comfort Level.

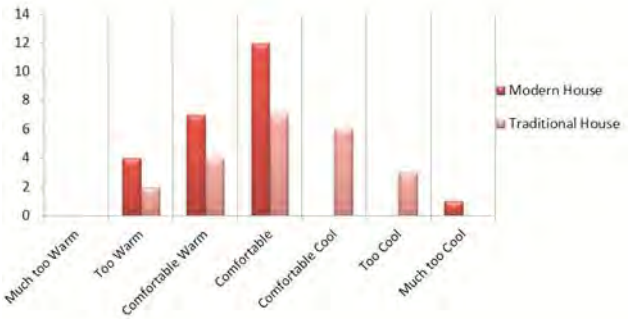

Figure-17: Thermal Comfort Level of Traditional and Modern Houses for Summer Season in Lahore.

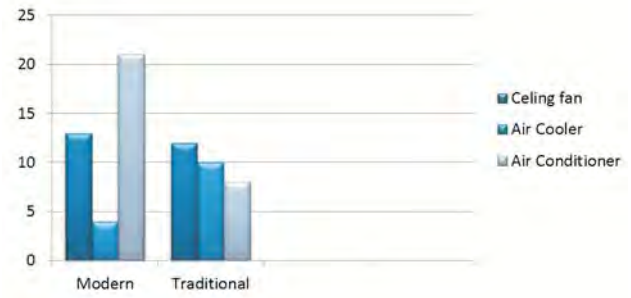

Figure-18: Electric Appliance Usage for Cooling During Summer Season in Traditional and Modern House in Lahore.

of the residents of modern houses wanted to continue to live in modern houses in the future, whereas seventy percent of the respondents of the traditional houses desired to continue living in their houses in the future too.

Another important objective of this survey was to inquire about residents' psychological response, besides physical comfort for the indoor thermal environment, due to high temperature and inability of houses to cope with hot summers in absence of mechanical aids of cooling. In response, residents of modern houses complained more about physical discomfort and difficulty in coping with daily activities, as compared to residents of traditional houses (Figures 19 and 20).

The extent of use of outdoor space was almost the same in the modern and traditional houses. Residents preferred to spend more time in the outdoor spaces in the evenings and at night time, while they preferred to stay indoors from noon till evening. In traditional houses the residents were spending almost the same amount of time sleeping and entertaining in courtyards, verandas and on roofs (Figure 21). Residents of modern houses preferred to utilise the front lawn in the morning and evening time. Residents of traditional houses used the rooftops in the evening, and slept there at night time too (Figure 22).

Micro-climate is an important element that affects human thermal comfort, in terms of physical and psychological response and can be modified through design. Amadouni emphasizes the need and significance of a space incorporating some elements of nature; 'even a tiny private courtyard-garden, open to the sky and the elements, fulfils the occupant's need to be in contact with nature. It also confines the extents of his/her vision, thus demarcating his/her territory and providing a frame to enjoy the ever changing diurnal and seasonal time' (Amadouni, 1994: 44). Thus, the courtyard houses not only provide a solution to achieve thermal comfort but help bring nature in closer contact to the inhabitants, if designed adequately. The higher satisfaction level for thermal comfort and ability to perform daily activities in the multi-purpose space of the courtyard, and lesser dependence on mechanical means of ventilation, hence proves courtyard houses to be more thermally responsive in comparison to modern houses.

FINDINGS THROUGH INTERVIEWS ON FACTS OF DECLINE IN COURTYARD HOUSES IN LAHORE

The interviews with architects informed about the various

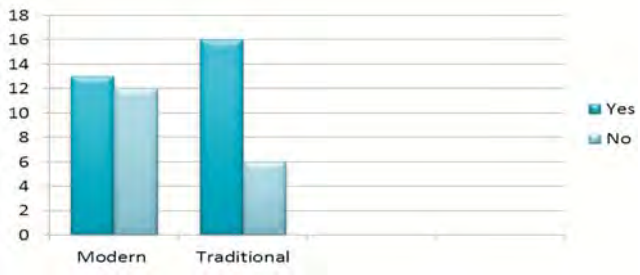

Figure-19: Satisfaction/Dissatisfaction with Thermal Comfort Level in Traditional and Moden Houses in Lahore.

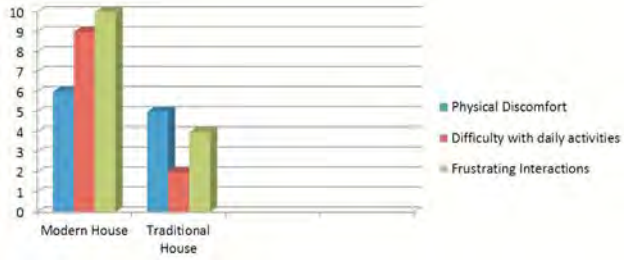

Figure-20: Feeling to be Uncomfortable Due to Thermal Comfort Level in Traditional and Modern Houses in Lahore.

Traditional House	Morning 8am -12am	Noon 12am - 6pm	Evening 6pm - 10pm	Night 10pm - 7am
Patio	**	**	*****	
Courtyard	******	*	**********	*******
Roof	**	*	*********	*****
Veranda	*********	****	***	*****
Indoor	*******	********** *******	*****	********

Figure-21: Use of Indoor and Outdoor Spaces During Different House of a Day in Traditional Houses of Lahore.

Modern House	Morning 8am -12am	Noon 12am - 6pm	Evening 6pm - 10pm	Night 10pm - 7am
Patio	***	*****	****	
Front Lawn	**********	**	**********	
Roof		*	*********	*****
Veranda	***	*	*****	
Indoor	*********	********** **********	******	********** **********

Figure-22: Use of Indoor and Outdoor Spaces During Different House Of A Day In Modern Houses Of Lahore.

reasons behind the decline in courtyard housing. The first reason is the stigma attached to courtyard houses. Wide range fluctuations in economic circumstances warrant only high income group to achieve purposely built traditional houses specially designed by architects who have expertise in traditional and vernacular architecture. However, on other side, low income group living in old historical areas of city of Lahore have courtyard houses in dilapidated situation often stigmatized as old fashioned.

The second reason was lack of adequate security as being a major concern behind preferring a modern house. Because of the security threat people do not prefer to sleep outdoor and prefer to have only one entrance/exit door for the entire house. They cannot keep doors and windows open all night, so courtyard houses are no more considered to be safe in this situation.

Another reason of preferring a modern detached house was expensive land value and the requirement for provision of compulsory open space, according to the laws of the building regulatory authority. These laws force occupants to cover as much space as possible on the plot (after leaving setbacks) in a way that maximum number of rooms can be achieved to accommodate all family members, which does not leave space for a courtyard. Individualisation of rooms and privacy demand, not only for women. With increasing vehicular demands, a car porch is a requirement in a house too. Thus, after having accommodated all these spaces, little or no room is left to design a courtyard.

Socio-cultural variations also influence different aspects of life. One reason for the decline in the desire for courtyard houses is breaking up of nuclear families. With the passage of time, and with the nuclear family system in decline, the courtyard house is being abandoned with trends showing shifting towards modern, single family, detached house. A local architect designing modern villas, mentioned that due to the impact of globalization and frequent travelling experience in western countries, people demand to have a western house. Lack of regional identity and local character in residential built environment is a major concern behind decline of courtyard house. An attraction and desire for modernization and international style; followed by an exotic display of wealth adds to a demand for a detached bungalow style house. Lack of concern for addressing indoor micro-climate and thermal comfort levels results in dependence on mechanical heating and cooling systems. Therefore, courtyard houses find it hard to keep their identity and prestige. The transforming trends of courtyard housing have also resulted in the loss of skilled labour, masons and experts who are skilled in local construction and decoration techniques.

RECOMMENDATIONS AND CONCLUSIONS

A courtyard house is a versatile typology which serves a wide range of affordability, which is one of the greatest challenges of contemporary times. Courtyard housing can be cost effective and climatically responsive. Besides, by adjusting bye-laws and promoting the use of indigenous materials such as bricks, lime plaster, terracotta tiles and wood a courtyard house can add a local flavour to the urbanscape. A courtyard house can also incorporate natural vegetation with water bodies to improve the overall ecological footprint of the house.

A typological analysis of courtyard houses in various regions by Amadouni (1994) demonstrates that it can have various spatial organizations, for example I-shape, L-shape, U-shape, O-shape, B-shape, T-shape, H-shape and Z-shape. These patterns can be adopted according to the shape and size of plot. A typical layout house plan of Ancient Greece (Priene), mentioned by Reynold (2002), is an example of a courtyard house with an elongated narrow frontage. Therefore, with slight variations in housing setback byelaws, an efficient and functional courtyard house can be designed. Instead of alleys as predetermined compulsory open space, a certain proportion of open rectangular or square space, adjacent to the neighbouring plot and separated with partition walls can serve as a communal courtyard. This can be a visual retreat for all connected rooms and a breathing space with a tree in the centre for shading.

Adaption of modern techniques, new materials, design and layout patterns of houses have contributed in raising heating and air conditioning demands. Even small capacity heaters and air conditioners can have a major effect on optimal house indoor environment, which is designed with passive techniques. Maximum reliance on mechanical aids to meet our needs of thermal comfort has resulted in losing indoor outdoor connections.

There are certainly limits to the extent that we can cautiously improve our indoor environments by adjusting external climatic factors and by incorporating passive methods of design. However, beyond this limit, we need heating and cooling aids which consume energy. Consciously planned and designed houses with a passive design approach and an additional support of active techniques complement each other. Nowadays problems arise when we exceed our dependence on heating and cooling devices, as a consequence

we unconsciously increase energy consumption which results in depletion of natural resources. On one hand these modern devices provide a comfort level and on the other hand they contribute to environmental hazards, by expelling negative heat content as waste output. We are not breathing natural air; we breathe mechanically processed air which has reduced our powers of resistance and capacity to bear climate forces.

In short, old wisdom of our traditional values blended with contemporary trends and needs can be a subtle combination to overcome our local issues of energy consumption, physiological and psychological comforts, as well as saving our built environment from degradation for our future generations.

REFERENCES

Al-Azzawi, S., 1984, "A Descriptive, Analytical and Comparative Study of Traditional Courtyard Houses and Modern Non Courtyard Houses in Baghdad; In the Context of Urban Design in the Hot Dry Climates of the Sub-Tropics", PhD Thesis, Bartlett School of Architecture and Planning, University College, University of London, UK.

Amadouni, Z. S., 1994, **"**Courtyard Housing, A Typological Analysis", Masters Thesis, McGill University, Montreal.

Donham, D., 1960, "The Courtyard House as a Thermal Regulator", *The New Scientist*, 8: 663-666.

Edward, B., Sibley, M., Hakmi, M. and Land, P., 2006, *Courtyard Housing; Past, Present and Future,* New York, Taylor & Francis.

Fathy, H., 1986, *Natural Energy in Vernacular Architecture: Principles and Examples With Reference to Hot Arid Climates*, Chicago, University Press.

Government of Pakistan Finance Division, 2020, "Pakistan Economic Survey 2017-2018" viewed 23-1-2020, from http://www.finance.gov.pk/survey_1718.html.

Olgay, V., 1963, *Design with Climate*, Princeton University Press, Princeton, New Jersey.

Rapoport, A., 1969, *House, Form and Culture,* Englewood Cliffs, N. J. Prentice Hall.

Randhawa, T.S., 1999, *The Indian Courtyard House,* Prakash Book Publications, New Delhi.

Reynold, J., 2002, *Courtyards, Aesthetics, Social and Thermal Delight*, John Willey & Sons, New York.

Ron Apelt, et. al., 2003, "Building and Landscape, Design Guidelines Towards a more Sustainable Subdivision," State of Queensland Department of Public Works, Australia.

Sadiq, N., 2010, "Climatic Variability and Linear Trend Models for the Five Major Cities of Pakistan", *Journal of Geography and Geology*, 2, 1: 43-50.

Sharif, S., Zain, M and Surat, M., 2010, "Concurrence of Thermal Comfort of Courtyard Housing and Privacy in the Traditional Arab House in Middle East", *Australian Journal of Basic and Applied Sciences,* 4: 4029-4037.