Environmental, Behavioural and Aesthetic aspects of Courtyard Design: Literature Review

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Abstract: Traditional courtyard houses in India are indigenous types of houses. They have been developed throughout ages by trial and error to a state of general acceptance, and their development can be traced back to Indus Valley Civilization. They seem to have fulfilled the needs of their inhabitants from the points of view of functional requirements, socio-cultural and religious demands, micro-climatic and internal thermal environment performance, energy saving, and economic means. They incorporate desirable architectural qualities of their own, both internally and externally.

The traditional courtyard houses in past few decades have lost their significance in India and there could be many reasons for it. The people are more concerned about their image than integration of space, the blind walls and doors are rejected by people. The building byelaws have restricted the courtyard option due to front and rear setback on small plots. The change in family structure from joint to nuclear have replaced family lounge to courtyards. The need of high rise high density, utilization of full ground coverage and F.A.R had have lead to apartment housing in place of courtyard houses. The person needs air-conditioned space for comfort and they do not want to cross open space instead shorter distances are preferred.

There is need to study the traditional as well contemporary courtyard design on the various parameters such as environmental, behavioral and aesthetic to find out the relevance courtyard design in modern context and their possible design solution in different climatic zones. This paper has compiled the literature review of research papers, master’s thesis, ph.d thesis of various authors on different aspect of courtyard design.

Key words: Courtyard design, indigenous, Indus valley, traditional, climatic zones.

1. Introduction


2. Courtyard Design in India after Independence:

After Independence in 1947, the architecture of India was having two philosophical directions; one direction was to follow principles of modernism borrowed from west and other was searching the roots of traditional architecture along with modernism. The prime minister of India Jawahar Lal Nehru has invited Le Corbusier for designing of Chandigarh in 1951 and in brief it has emphasis that Chandigarh should be design away from traditional architecture. Courtyard planning has not been given any importance in Chandigarh. In spite of so much neglectance of traditional architecture by
Government, many great architects of India have understood the wisdom behind the traditional architecture. These architects have incorporated the traditional concept of courtyard in their projects e.g. B.V. Doshi in IIM Bangalore and NIFT Delhi, Charles Correa in Gandhi Samark Sangrahalaya, Bharat Bhavan, Vidhan Bhavan Bhopal, Jawahar Kala Kendra, Jaipur Joseph allen Stein in India Habitat Center, Raj Rewal in National Institute of Immunology and so on.

3. Relevance of Courtyard in Modern Context:
In 1990 the new economic policy of Liberalization has lead to Globalization. Globalization was perceived as an economic integration phenomenon is no longer just political or economic, but it is a cultural phenomenon as well. Increasing interaction and integration across borders due to globalization diminish differences between nations, causing global norms, ideas, and practices to dilute local cultures. [3]

The local traditional courtyard houses have been replaced by either apartments or contemporary houses without courtyard, which can be fitted anywhere irrespective of climate, social, cultural background.

Many people are arguing that courtyard houses in low rise low density or low rise medium density are not relevant in present context to cater the need of increasing pollution and limited land availability. In past few decades the high rise high density, mid rise medium density housing has been built across India but high rise housing has lead to many Psychological issues and still one portion of society would like to prefer live in low rise low density or low rise medium density houses. The courtyard houses may be still relevant in present context also to provide options to fulfill diversified demands of people.

The great Egyptian architect Hasan Fathy writes “In the context of sustainability where ecological issues are of prime importance, courtyards can still be perceived as an important design element that functions both as a social space as well as something that reduces the carbon footprint of the building. One of the areas to look for energy-efficient architecture might be to go back and reinvestigate traditional architecture such as courtyard houses”. In 2005, first platinum rated building CII –Shorabji Godrej center has been built on the concept of traditional courtyard and many other buildings built on sustainable concept using courtyard as design element such as Pearl Academy of Fashion, Jaipur by Morphogenesis, Indira Paryavaran Bhavan at New Delhi etc.

4. Environmental Aspect of Courtyard Design:

1. B. Vedhajanani and A. Lilly Rose in the research paper titled “Contextual Comparison of Courtyard Houses in Tamil Nadu” describes the comparison between traditional and modern courtyard in Tamil Nadu on the basis of Physical aspect, environmental aspect and behavioral aspect. Under the Physical aspect and environmental aspect the traditional courtyard has its major axis along N-S and entrance from East, the courtyard acts a good light source, good source of ventilation and maintains thermal comfort to occupant in different climatic seasons. On the other hand the modern courtyard courtyard acts as light well to only few part of house and have n role to ventilation or thermal comfort significantly. [4]

2. Dilli A. S., Naseer M. A., Zacharia Varghese T. in the research paper titled “The influence of internal courtyard of Kerala traditional residential buildings in providing a comfortable indoor environment” experiment of smoke test in one house in two modes, the first one is wind movement outside and second is still air outside .The results indicate that the smoke’s upward movement is faster when wind movement of outside has been taken in consideration and it is slow for still air outside but in all cases the wind is moving upward. This clearly indicates the wind movement through courtyard in hot humid climate for human comfort.[5]

3. Farzaneh Soflaei, Mehdi Shokouhian and Seyed Majid Mofidi Shimirani in the research paper titled “Investigation of Iranian traditional courtyard as passive cooling strategy (a field study on BS climate)” concluded appropriate orientation considered as NW-SE with 10-45 degree tilt or E-S direction but latitude /longitude should be taken care of simultaneously. For dimension and proportion, that length to width ratio of courtyard varies between 1.09 to 1.68 and for courtyard walls and windows, the opening on north and south has been focused more as compared to east and west , the maximum opening are given on north and in some cases it is 94 % but normally it varies between 17 -33 % average .

The proposal in terms of design equation is given and it is observed that best length and width ratio lies can be find out for contemporary courtyard through equation W=.8L+.17 and around 17 % could be assigned for natural elements out of 9 % could be for vegetation and 8 % could be for water . The height of façade in north as well south should be higher than façade of east and west. The proposed opening should be in the range of 21-29 % on north and south façade, 17-18 % on east and west façade. [6]

4. F. Solae, M.Shokouhian discuss in their research paper titled as “Environmental effect of courtyard in sustainable architecture of Iran (Hot-arid regions, meso-climate BWks)”, about environmental analysis of courtyard in traditional Iranian houses. There are many criteria of evaluation such as symmetry between solid
space (occupied space) and void space (courtyard space), the extension direction and rotation angle, proportion associated with dimension of courtyard, the proportion related to physical bodies of courtyard such as earth and water, symmetries of artificial bodies (quadruple elevation of courtyard), symmetries of opener in artificial bodies (openers in four elevations). It is being concluded that in all courtyards the occupies space to unoccupied space (courtyards) is 60:40%, orientation mainly depends on wind direction, the proportion of water is around 10% and earth is 20%, the northern surface is around 37%, southern surface 33% and rest is eastern or western surface. The opening on north surface 22%, southern side 28% and eastern, western side 39%.

5. Ahmed S. Muhaisen in the research paper titled “Shading simulation of the courtyard form in different climatic regions” concluded that hot humid zone the optimized courtyard ratio between 3-7 and hot dry region varies between 4-8. While in temperate and cold regions, square courtyard will function well. In hot humid area the longer axis should face NE-SW while in temperate as well cold climate it should be N-S and in hot dry it should be in between NE-SW to N-S to achieve better performance of courtyard.

6. The research paper titled “Comparative Study between Three Courtyards of Traditional Houses in Islamic Cairo” by Yehia Hassan Wazeri describe in hot arid region like Cario; the main objective is to reduce the solar radiation in summer and maximize the solar radiation in winter. The study conducted for three traditional houses for shading and direct solar heat gain (21 June and 21 December) in courtyard on walls, floors and openings. It is being concluded that the enclosure ratio and projection have significant effect on increasing shaded area. The average height in all courtyards does not exceed one half and the width of courtyard except one case. Each façade of the courtyard has its own design, opening ratio and arrangement as per solar radiation, the north façade has maximum opening.

7. Yasa Enes and Ok Vildal in the research paper titled as “Evaluations of effects of courtyard building shapes on solar heat gains and energy efficient according to different climatic regions “ describe courtyard forms affecting the Thermal comfort status and energy performance in different climatic regions hot-dry, hot-humid and cold climate. The research is being carried through CFD Computation Fluid Dynamics (CFD) is simulation tool to predict convective heat transfer through building surfaces. The courtyard form has been stimulated by varying the heights, H, 1.5H, and 2H, 2.5H options. It is concluded that gaining solar radiation in winter is more critical then evading the summer heat in summer, required energy demand is parallel to its length, in case of square the energy demand is less, annual energy consumption increases as the courtyard building shape gets longer as a direction of prevailing wind.

8. Tofigh Tubes and Begum Setyesilisik discuss in research paper titled as “An Investigation on Energy Efficient Courtyard Design Criteria” about the importance of energy efficiency of building in 21 century and courtyard can act as passive way to reduce the energy consumption in buildings. The authors describe the reasons for including courtyard in buildings such as Psycho-social, Cultural, Energy, Architecture, Symbolic – religious and economic benefits. The paper analyzed the shape of courtyard in deciding the energy consumption, circular form courtyard get affected easily for shading only through minor change in dimension, the deep courtyard are good for summer and shallow good for winters. The solar radiation received on the surface of courtyard affects the required cooling and heating. The paper is purely theoretical in nature and references of various paper compiled logically.

9. Almeshafy Abdulbasit, Ibrahim Norhati, Ahmad Sabarinah Sh, Josmin Yahya in their research paper titled as “Analysis of the Courtyard Functions and its Design Variants in the Malaysian Hospitals”, describes the element of courtyard used in architectural design for social, environmental and therapeutic potential. The design variant in courtyard design plays very important role. The main design variants are functions, configuration, orientation, wall enclosure, natural element within courtyard etc and these design variant could be further detailed out in the form (square, rectangular, triangular or other), shape (O-shape, U-shape, L-shape, I-Shape), orientation (north, south, east, west), shading devices (RooF, overhang), water ground ratio, vegetation ground ratio, healing properties, courtyard plan aspect ratio etc. It has been found in the observation Malaysian hospitals have different configuration such as cluster (Multiple, spine), closed, open and interlinked. The courtyard functions are used mainly as garden; lighting and ventilation except in few courts have been used for healing or play ground. The orientations of courtyards have been kept mostly NS or EW.

5. Behavioural Aspect of Courtyard Design:

1. Nibedita Das in her Masters of Architecture Thesis, Kansas State University Manhattan, Kansas titled “Courtyards Houses of Kolkata: Bioclimatic, Typological and Socio-Cultural Study” describe the Phycho-social benefits, cultural benefits, climate benefits and symbolic – religious benefits. The Psycho-social benefits include the sense of enclosure and privacy, act as “outdoor room” for multipurpose activity like kitchen extension in morning and living for guest in evening, safe place for children under the supervision of elder, acoustical privacy free from the noise of street. The cultural benefits include the adaptability of courtyard in different culture, occidental and oriental culture use courtyard
differently. The occidental focus on social values, wealth and social status and it is reflected in too much decoration in their courtyard façade while oriental focus on functional use of courtyard to maximum utilization. The symbolic and religious benefits include courtyard symbolize the inwardness and feminism, oasis in desert , a fragment of nature inside the house , a concentration of light , wind , sound and water etc. The courtyard in Hindu religion follow cosmic square of theology Vastu purush Mandala and space is use for daily ritual of religion at tulsi plant in courtyard. [1]

2. B. Vedhajanani and A. Lilly Rose in the research paper titled “Contextual Comparison of Courtyard Houses in Tamil Nadu” by describes the comparison between traditional and modern courtyard in Tamil Nadu on the basis of Physical aspect, environmental aspect and behavioral aspect. Under the behavioral aspect traditional court has so many activities such as used for drying clothes, groceries and food products like red chili, groundnuts, a secured play area for small children of pre-school age who can be taken care by their mother ,a wash area, collects and stores rain water in rainy season, uses the washed water under recycling process for again washing sunken floor against screenings that are found remaining from cleaning vessels and utensils especially when rain is scarce. This conscious but sophisticated flexibility in plan can be attributed to the proximity between kitchen, pooja and courtyard.

On the other hand the modern courtyard is very small and being used as an extension of the living cum dining room and some food products are stored sparingly. Tiny cuddapah slabs protruding in a staggered way from the wall carry artefacts. The space is used by the female community of the house during mornings and evenings but rarely. [4]

3. Nancy Yu in her Master in Landscape Architecture thesis on the topic “Urban Housing Form as response to Human needs, culture and Environment” describe the courtyard housing has been emerged as basic need of Humans. The socio psychological factors involves privacy, security and social status of person. The cultural factors involve use of Feng Shui or Vastu purush Mandala and courtyard are mostly used by women. The contemporary courtyard are having privacy but not reflecting the social status of person and mostly lacking cultural factors. The contemporary courtyards are not very symmetrical in terms of form and various shapes L, U explored along with rectangular traditional courtyard are used. [13]

4. Ashraf SALAMA in the research paper titled, “A Typological Perspective: The Impact of Cultural Paradigmatic Shifts on the Evolution of Courtyard Houses in Cairo” analyze the evolution of courtyards from 1700 to late 1900 on the various parameters such as entrance; takhtabush (covered outdoor sitting- at ground floor level located off the courtyard and in the nearest area to the entrance), qa’a (reception hall),Maka’ad (a square and rectangular shaped covered loggia opened with its entire façade into the court, essentially oriented to north in the grasp of the soft breeze) in the form of sketches. The paper concludes the changes and evolution of the spaces in courtyard houses due to cultural shift.[14]

5. Zareh S. Amadouni, in his M.Arch Thesis titled as “Courtyard Housing: Typological Analysis” discuss about the courtyard housing typology could be very effective in dealing the forthcoming issues of high density, socio-cultural interaction and sustainability. Apart from dealing the issue of high density, courtyard could be effective in dealing the ground relatedness, Security, territoriality, dwelling identifiability, image of home, personalization, adaptability to alternative lifestyles, the provision of private outdoor space, and child surveillance possibility.[15]

6. Aesthetic Aspect of Courtyard Design:

1. M. Salim Ferwati & M. Alaa Mandour in the research paper titled “Proportions and Human Scale in Damascene Courtyard Houses” conclude that two courtyard were having proportion 1:4 , 1:2 and while the other three courtyard were having proportion 1:1.6, 1:1.3,1:1.2. The courtyards are not having fixed ratio and it cannot considered as case of uncertainly but it reflects the flexibility in culture to have different perception about aesthetic .

2. Nabavi, F., Yahaya, A. and Goh, A. in the research paper titled “Geometry and Proportion of Traditional Houses in Hot-Arid Region, Iran” conclude that almost all 30 courtyard chose for study are rectangular in shape the rooms surrounding around courtyard, the length to width ration is all cases lies between 1.3 to 1:7 but more courtyard were having proportion of 1.3 & 1.5. These ratios are not matching to Iranian golden ratio of 1.176. [17]

3. B. Vedhajanani and A. Lilly Rose in the research paper titled “Contextual Comparison of courtyard Houses in Tamil Nadu” conclude that solid and void ratio of traditional courtyard is 1:5 while the modern courtyard has only 1:05 very small as compared to the size of house. The traditional courtyard is very appropriate in terms of aesthetic while the modern courtyard is just acting as light well. [4]

7. Conclusion:

The various literature reviews shows that there are variations in courtyard design for different climatic conditions, socio–cultural influences and aesthetic parameters. The various studies of environmental aspects clearly define the physical parameters of courtyard i.e. proportion, size, orientation etc are being determined on the basis of
solar path, wind direction and movement etc. The study of behavioral aspect also defines the various usages of courtyard for different activities, change in courtyard design due to change in socio cultural values. The study of aesthetic aspects also define the courtyard size, proportion are affecting by aesthetic norms fixed by particular community.

It can be concluded that courtyard design have been explored in various regions of the world on the basis of environmental, behavioral and aesthetic aspect. There is so much variation in courtyard design in different part of world which clearly shows the versatility of courtyard design. The courtyard design could be very creative solution to meet the present need of people due to its versatility.

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9. References