

Adapting the Concept of Courtyard in Long–Narrow Attached Houses as a Sustainable Approach: The Saudi Experiment

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Abstract

Studying and investigating the concept of courtyard in residential buildings in contemporary Arab architecture allows the distinctive nature of tradition to be reinterpreted in the context of the contemporary era. Although most Arab people link the courtyard house with the traditional lifestyle, an increasing number are keen to see the courtyard typology adapted to modern needs. At this point, critical research questions are raised; how can we adapt the courtyard typology to modern needs, what design principles should be followed, and what are the likely urban consequences. This paper attempts to answer the previous questions and address the issue of adapting the courtyard concept in the long-narrow attached houses as a sustainable approach for hot arid regions. To tackle the research problem and answer its questions, a Saudi experiment of two contemporary courtyard housing projects will be analysed, investigated and discussed. Saudi Arabia is one of few countries in the world where most people still adhere to a strictly traditional way of life whilst at the same time having the wealth to possess advanced means of technology. Through the selected two projects the concept of courtyard will be examined and assessed in the long-narrow attached houses to set design principles and guidelines that could be followed in dealing with the issue of courtyard in contemporary residential buildings in the region. The paper discusses the characteristics and advantages of long-narrow attached courtyard houses in the region. It also examines the appropriateness of this approach for housing projects in the region with particular focus on the new urban developments in Egypt.

Keywords:	Courtyard house, Long-narrow house, New urban developments, Saudi courtyard house
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1. Introduction

This research focuses on the Saudi experiment in utilizing long-narrow attached courtyard house because of the richness of the experiment compared to similar attempts in the region and also because of the distinctive nature of the Saudi society. Like many other traditional societies, Saudi society has been subject to a great many changes due to the phenomenon of globalization and this has resulted in a conflict between the authentic and the occidental, the local and the global, the traditional and western models [1]. Many people in Saudi Arabia continue to believe that the courtyard house is a manifestation of the local tradition linked essentially to the poor past. They have doubt regarding the appropriateness of the courtyard house to the contemporary needs of Saudi society, especially in the area of climate moderation and gender privacy. This notion could be ascribed to a couple of factors: (a) misunderstanding of the different values of this concept, and (b) the lack of appropriate contemporary models of the courtyard house that fulfil the needs and hopes of the contemporary Saudi society [2]. Focusing on the long-narrow house as a model through which the concept of courtyard is adapted is based on the significance of utilizing this approach at socio-cultural, economical and environmental levels.

To answer the research questions and attain its objectives, the research method will rely on discussing the theoretical background of the concept of courtyard and its significance. In addition, a documentary analysis of the advantages of the long-narrow house will be carried out including analysis of one western example in the UK. Based on the theoretical discussion and data collected from designers and their firms' archives the main two case study projects in Saudi Arabia will be analysed to answer the research questions and identify design principles and guidelines for future applications.

2. Significance of courtyard

As a theoretical background to build a clear and reliable discussion, it is important to shed some light on the significance of courtyard at socio-cultural, economical and environmental levels:

Cultural significance

In Islamic societies, visual connection to the sky enhances many significant religious values and courtyard represents the window of the house to the sky. Courtyard ensures privacy for the house inhabitants especially women, as an important part of the household daily activities take place in the courtyard. In addition, reliance on the courtyard in the natural lighting and ventilation for the house spaces minimizes the need for windows in the external facades which supports the principle of privacy.

Economic significance

The courtyard minimizes the energy consumption in artificial lighting and ventilation during the day. The household can utilize part of the courtyard in growing vegetables and fruits for their usage. In case of adopting the concept of attached courtyard house (from 3 sides) and reliance on one external façade, the facades' construction cost is reduced by 75%.

Environmental significance

As the courtyard is shaded most of the day hours, it helps in reducing the thermal pressure, solar exposure and glare from reflected sun rays. The courtyard also plays an important role in enhancing the air movement in the house as the hot air in the court moves upward letting the cool air to flow from the rooms' windows replacing the hot air in the court. In a study of housing typologies of the southern part of India, parametric modeling results show that courtyard houses have a 50% less cooling load requirement compared to other

generic building forms used in the same location [7]. The courtyard helps in protecting the house spaces against sand storms. In addition it helps in isolating the house inhabitants from the street noise. Green areas and water features in the court helps in reducing the air temperature and purifying the air from dusts.

Social and psychological significance

The courtyard achieves the interaction between the inhabitants and the elements of the surrounding environment such as the sun, moon, sky, clouds, rain, especially for women and children. The courtyard also enhances the feeling of safety and sense of containment. In addition to its role as a circulation hub in the house, the courtyard could be used as a dining or living space or children play area.

3. Traditional courtyard house

The courtyard house was found in ancient civilizations like Egyptian, Greek, Roman and Persian architecture, where its fundamental role was identified through social factors and environmental considerations [3]. Islamic architecture was distinguished by compacted urban fabric with narrow streets and courtyard houses with solid high external walls [4]. At this point, it is important to indicate that the introverted approach of house design in Islamic culture and negligence of external facades led to the reliance on internal courtyard as one of the main elements of Islamic house design.

If we look at the traditional societies in the Arab world, we find that the courtyard house was the dominant housing type. In Cairo, traditional Islamic house was distinguished by its courtyard with a central garden and rich architectural vocabularies including wood works that are reflected in its architectural elements [5]. The image of the remaining examples of this house type in old Islamic Cairo – Assehemi House for example Figure 1



Figure 1. Assehemi house in old Islamic Cairo



Figure 2. Traditional courtyard house in Saudi Arabia

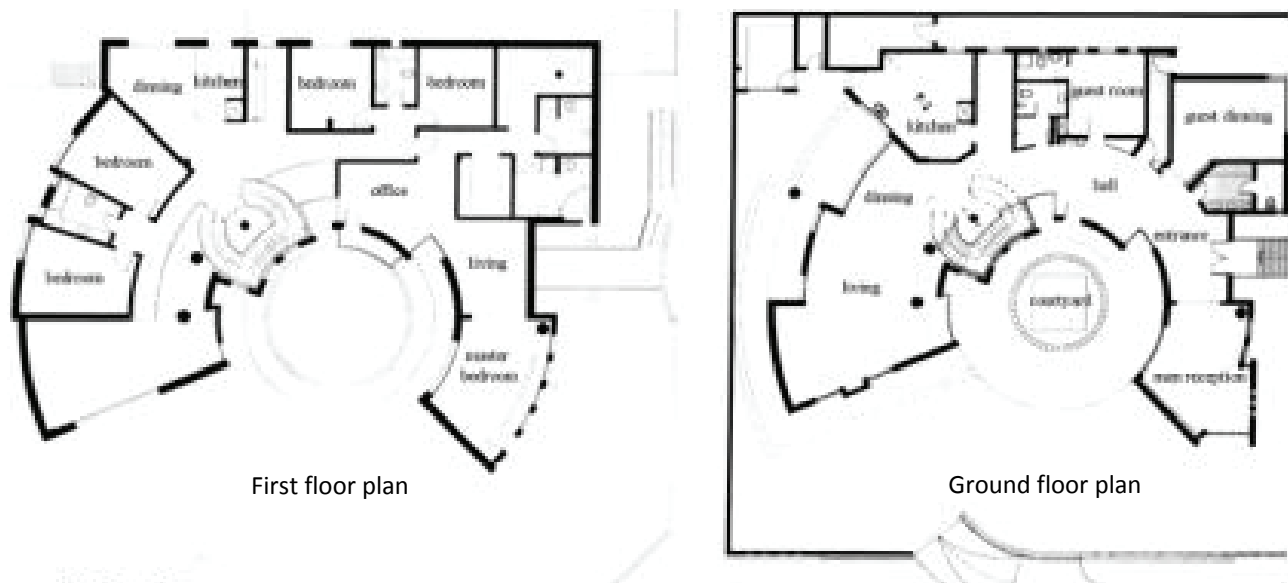


Figure3. Plans of a circular courtyard house in Saudi Arabia



Figure 4. The circular courtyard of the house

gives the impression that such models are inappropriate economically for the present time with the calls for minimizing the construction cost. While, in the central region of Saudi Arabia where the residential areas are characterized by the compacted masses of attached houses with one or more courtyards and front and back entrances, the image is different [6]. The image of the remaining examples in this case gives the impression that the model is inappropriate for the present time because of the simple and primitive nature of the example Figure 2.

4. Courtyard in 'modern' Saudi house

At this point, it is important to discuss one of the attempts carried out by a local Saudi Architect to adapt the concept of courtyard in a modern house. This

modern house was built in Riyadh in 2001 with a total plot area of 1300 sq. m. Figures 3 and 4. The architect attempted to integrate the concept of courtyard typology into a western oriented design where the spaces are arranged in an open and free plan layout [8]. To discuss the appropriateness of this contemporary courtyard house to modern needs, we need to examine it from different perspectives. The emphasis of the analysis will be on the spatial organization around the courtyard in the context of contemporary social and cultural values. From the cultural point of view, the courtyard in this house does not ensure total privacy for women at two levels. First, as the courtyard is open to the main façade and exposed to the neighbouring buildings, it cannot be considered as a private enclosure. Second, the entrance lobby and men's reception hall partly overlook this court. This may hinder the women free movement and use of this space when receiving guests in the men's reception hall.

The original role of courtyard as a thermal modifier inside the house is questionable in this design. The open circular form of this courtyard minimizes the shaded facades and maximizes the exposure to the sun heat. With an open court to an adjacent garden and using thermally conductive materials such as steel and glass in its facades, this architectural design has provided a debatable environmental scenario, depriving the courtyard of its traditional climatic justification. It could be argued that the court in this design is better considered as part of the garden rather than an internal courtyard of the house. Hence, the functions and activities that can take place in this court are complementary to those that are acted out in the adjacent garden. This suggests that this courtyard design has failed both to attain the full range of cultural and

climatic advantages and to maintain the functional benefits of the courtyard typology. If we look at the aesthetic aspects in this courtyard, we find the variety of surface materials and treatments affects the required calm atmosphere for the courtyard. The extent of glazing and metallic panelling adds an alien dimension to the scene, and highlights the difficulty of balancing traditional and contemporary design.

5. Long–narrow attached house

Before investigating and analysing two projects of long–narrow courtyard house in Saudi Arabia, we need first to discuss the advantages of long–narrow courtyard house as an appropriate sustainable solution for hot arid regions. One of the biggest advantages of a long–narrow courtyard house is access to natural light. Narrow layouts permit daylight to enter the full depth of a space. Floor plans that are one room wide gather and distribute light very efficiently. In addition, narrow layouts offer plenty of natural ventilation opportunities. Openings opposite one another take advantage of the physics of natural convection through drawing cooler air into warmer spaces. At the cost level, stacking narrow plans vertically adds volume without increasing the footprint. This helps to minimize site costs, which can often be substantial.

It is important to indicate that the long–narrow attached house leads to a cheaper and more efficient system of subdividing land and providing service and infrastructure for urban areas. It conserves land and ensures the effective use of limited public resources. Investigating schemes with front to depth ratio of 2:1 through 1:1 to 1:6 plus demonstrated that as the lot ratio increases, economy in infrastructure and density increases [9]. This form of development maximizes the use of existing limited resources. For example, servicing a plot of 7.5-meter frontage will lead to a saving of 75% and 85% when compared to the cost of servicing a 30 meter and 60 meter plots respectively. In real terms, this means that 3 and 7 more additional plots can be serviced with the amount needed to service single 30 meter and 60 meter plots respectively [10]. The parcelling of lot with very narrow frontages means that these plots may also become more affordable. Other advantages which will spring from the use of long–narrow lot form of development include the densification of our cities, avoidance of unnecessary sprawl and the availability of more resources resulting from savings in the cost of transportation, in maintenance cost, and in the use of non-renewable resources such as gasoline. At a different level, a study made by Chermayeff, S. and Alexander, C. on housing design in the perspective of community and privacy concluded that long narrow multi-court house appeared

to be successful and appropriate in providing the community and privacy [11].

5.1. Western example

To build a constructive discussion of the Saudi experiment of the long–narrow courtyard house, it is important to discuss one of the similar western examples (Figures 5, 6 and 7). Accordia Housing project in Cambridge, UK will be investigated to enhance the argument through introducing similar approaches in different cultures. This substantial project is widely regarded as having set a whole new benchmark for large-scale housing in the UK. This multi award winning project, which was built in 2009 includes 382 dwellings in a variety of innovative house and apartment types in the form of terraces and courtyard houses. The design replaces traditional gardens with a variety of private open spaces such as courtyards, roof terraces, and large balconies. Dwellings use the entire plot depth with private garden space being created through courtyards and terraces at different levels [12]. All houses are the long–narrow courtyard configuration with front to depth ratio ranging from 1:2 to 1:4.8. A study carried out by Goh Tee and Magda Sibley on the users' perspectives of performance of Accordia courtyard houses concluded that this long–narrow courtyard house is very well liked by the users. All respondents confirmed the need for more than one type of open space in the home giving reasons such as 'flexibility of different uses and outlooks'

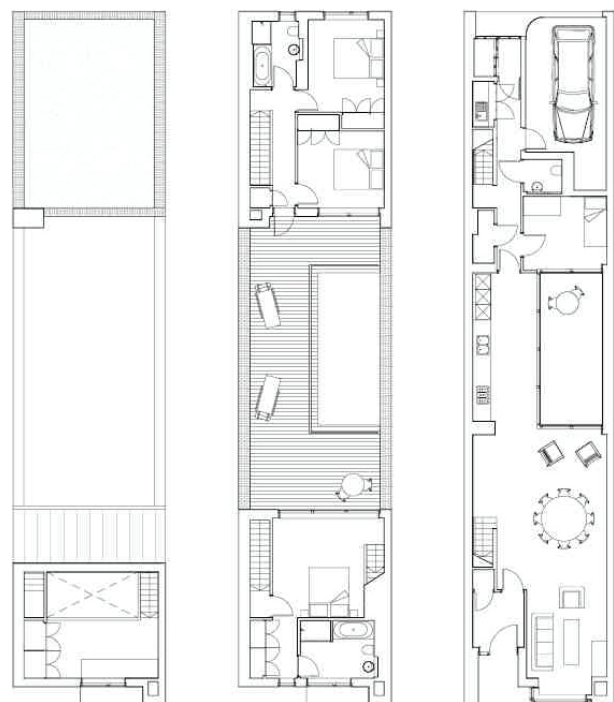


Figure 5. Plans of Accordia housing project



Figure 6. View from the living space to the courtyard

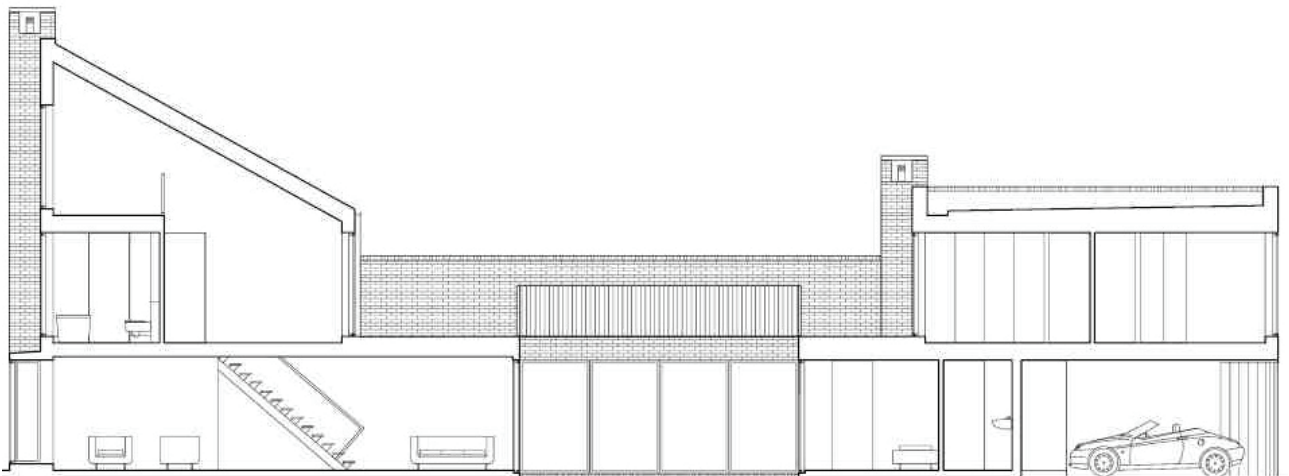


Figure 7. Cross section of the house through the courtyard

'direction of sun' and 'personal space in relaxing'. The open spaces in the home were used in domestic and leisure purposes, private exercise and part of access to the home [13]. It is clear that the positive response of Accordeia users regarding the performance of long-narrow courtyard house supports the previous discussion of the advantages of this house configuration.

6. The Saudi experiment

At this point, we need to focus on the Saudi Experiment of long-narrow courtyard housing through investigating

and analyzing two contemporary projects in Riyadh and Jeddah.

6.1. Project 1: Alnakheel housing project in Riyadh

This project was designed by Beeah Planners, Architects & Engineers in Riyadh, in 2002. It aims to develop an ideal and safe new residential environment within affordable cost limits. The site is located in Al-Nakheel district in Riyadh and occupies an area of 452,000 sq. m. The project houses 500 residential units with a range of

different sizes and designs, all based on the concept of courtyard housing. Each unit consists of ground and first floors within plot areas which vary from 176 sq. m. to 1475 sq. m. In addition to the residential units, the project comprises the necessary community facilities (schools, social centre, mosques, open areas and gardens, and commercial facilities) some of which also feature courtyard design.

The design concept of the master plan – Figure 8 – is based on encouraging social interaction by dividing residents to homogeneous groups. It also encourages

pedestrian movement by providing safe and pleasant walkways. In addition, it provides a pleasant and comfortable atmosphere for residents around a series of linked green spaces Figure 9. The residential clusters are organized around courts. These include children's playgrounds, small gardens and car parking facilities. The residential units are classified into six types according to their design concepts. This research focuses on three of them to explain the different approaches that the designer explored in the project as a whole [14].



Figure 8. Part of Alnakheel master plan



Figure 9. View of Alnakheel residential units and facilities

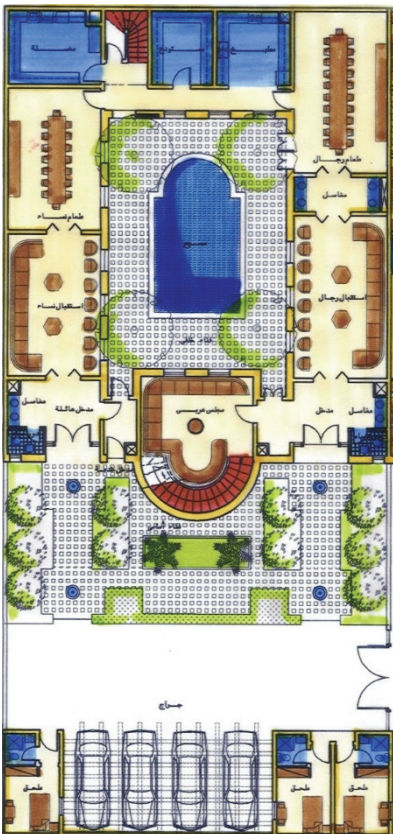


Figure 10. Ground floor plan of type A

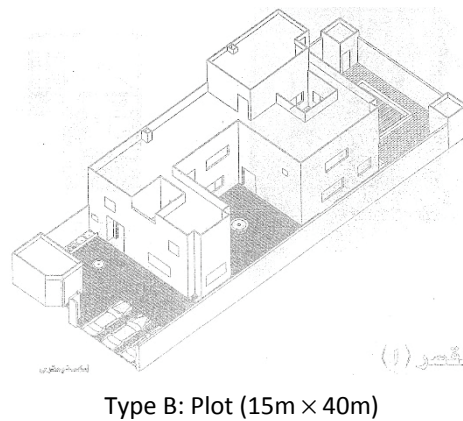
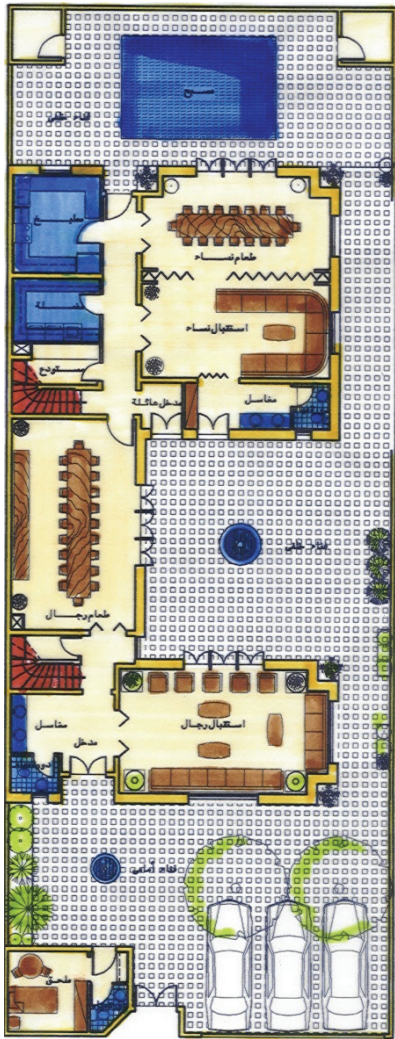


Figure 11. View of the residential unit of type A (plot 20m x 40m)



Figure 12. First floor plan of type A

In type A, the designer adopted the conventional courtyard in the center of the house surrounded by the other residential elements. In this design, all of the dwelling spaces are articulated around this courtyard and overlooking it, Figures 10 and 12. Reception and dining areas for both males and females share the same courtyard, which affects the level of privacy negatively



Type B: Plot (15m × 40m)

Figure 13. Ground floor plan of type B

in this layout. In terms of utilizing the courtyard space, the swimming pool in the middle hinders the use of the courtyard as a place for family gathering and activities. In addition, it ceases to function as a play area for children although the pool provides useful climate moderation Figure 11.

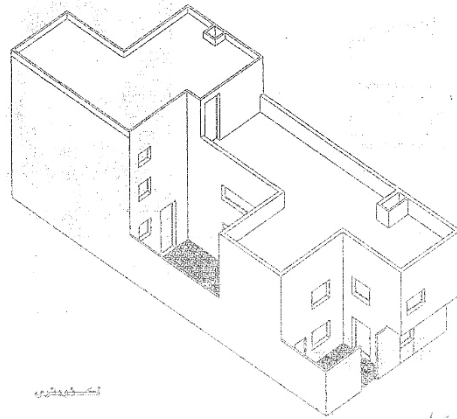
Figure 14. First floor plan of type B

In type B, the designer employed three connected courtyards with three different levels of privacy (Figures 13 and 14). The front courtyard serves as an entrance court for the dwelling and can be used by both the residents and guests. The male reception and dining areas are articulated around another courtyard, which is connected to the front courtyard. This approach ensures a proper segregation between male and female spaces, which is one of the most important considerations in Saudi culture. To the rear of the dwelling there is a third courtyard which is adjacent to the female area. This courtyard helps in ensuring an appropriate level of privacy for women and provokes physical segregation between male and female guests. However, as this courtyard is partly open to view on three sides to the surrounding external areas, there is a potential loss of privacy.

The third type of residential unit has a similar approach to the second type with some significant differences. The most important is that in type C the back courtyard provides for women a higher level of privacy than in type B, as the courtyard in type C is enclosed by rooms in three sides, Figures 15 and 16.

Table 1 summarizes the key points of the previous analysis of the three types of Alnakeel residential units.

From the previous analysis and assessment of the three types, it is clear that type C reflects the best performance at the concerned levels. The long-narrow layout gives the highest level of privacy, which is one of the key advantages of the courtyard especially in the Arab culture. At the economic level, it is also the most efficient in terms of area utilization and small frontage with long depth. The long-narrow layout also gives better environmental impacts in terms of variety of sun and wind directions with the three courtyards in different locations. At this point, it is important to link this discussion with the survey carried out in Accordia housing project and discussed earlier in this paper. The users of Accordia confirmed the need for more than one type of open space in the house for flexibility of different uses and outlooks and different directions of sun and wind. The multi-courtyards layout can be perfectly attained in long-narrow residential plots. Reshaping the plot proportions by utilizing the concept of set-back from the front and back sides to create front and back courtyards -the case of type B- is not the proper way of dealing with long narrow plot. This way affects the level of privacy negatively, in addition to the limitations of space usage.



Type C: Plot (8m × 21m)

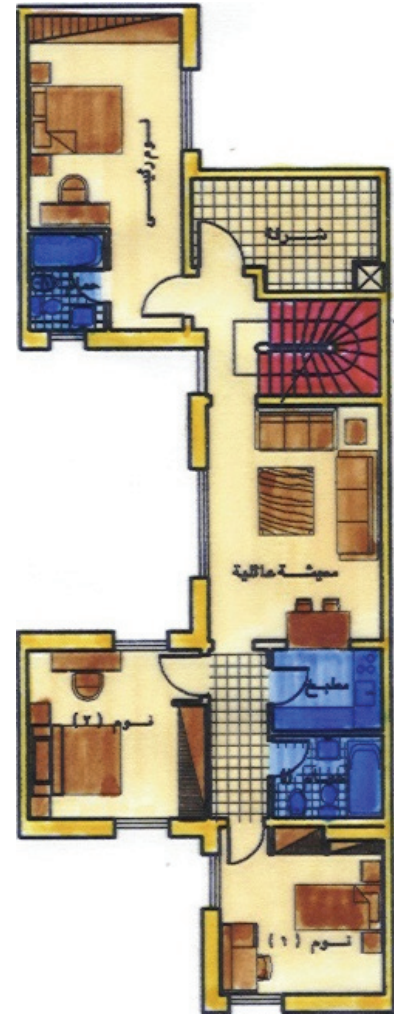


Figure 15. Ground floor plan of type C

Figure 16. First floor plan of type C

Table 1: summary of the key findings of the three types analysis

	Type A	Type B	Type C
Typology	Conventional central courtyard	3 connected courtyards (front, middle and back)	2 connected and one separated courtyard
Floor plan	almost square	rectangle (1:2.2)	long-narrow (1:2.7)
cultural dimension	privacy is affected negatively	appropriate level of privacy	higher level of privacy than type C
Economic	large courtyard but difficulty of usage	3 small courtyards with different usages	The most efficient in area usage
Environmental	reduce thermal pressure and enhance air movement	the 3 courtyards gives better results than type A	3 different courtyard locations gives better results than type B

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6.2. Project 1: Alnakheel housing project in Riyadh

This project was designed by the author and Dar Almajd Consulting Engineers. The site is located in Shabaan village in Jeddah and occupies an area of 250,000 sq. m. The project houses 220 residential units in two different sizes and designs. The general intent of the housing provision in this project is to create house designs and residential environment that are socially responsive, environmentally suitable, and economically viable. Social Responsiveness relates to the layout of the house, the provision of adequate indoor and outdoor living spaces, the specific zoning of a Saudi house to provide for family and individual privacy, reflecting traditional and contemporary Saudi way of family life, Figure 17.

Environmental responsiveness relates to building arrangements that are properly sited with respect to sun and wind, with the ability to shade each other. Space economy minimizing energy consumption, ease of maintenance, and availability, suitability and durability of building materials all are very significant factors that



Figure 17. Group of houses in a residential cluster

were taken into account in the house designs. Plot shapes and plot arrangements which influence the economy of infrastructure services and roadways were considered by using smaller plots and shorter plot frontages. The design intent is to create the housing areas as one consistent urban form which has an image of its own, Figure 18 [15].

The house design is distinguished by two courtyards, figure 19. The front courtyard services as a front entrance courtyard for visitors and the inhabitants utilize it also as a working space for handicrafts and other productive activities. The bedrooms and family living are articulated around the back courtyard forming a U shaped plan. This courtyard is utilized as the family courtyard with a higher level of privacy. It is connected to the back entrance, which leads to the cluster courtyard where the children can play and inhabitants can socially interact. The use of partially enclosed courtyard defines spatial balance of the courtyard space mediating between open and closed forms, Figure 20.

7. Discussion and conclusion

To answer the question of adapting the concept of courtyard to modern needs, it is important to consider the principles of sustainable architecture as a key factor. As discussed in the theoretical part of this research, long-narrow attached courtyard houses give ideal solutions for issues of sustainability at all levels. If we look at the analyzed four examples, of courtyard houses that designed on long-narrow plots, we can classify them into three types in terms of typology and floor plans. The conventional central courtyard house (type Ain project 1) lacks key sustainability principles compared to the other examples. While the second type which relies on front and back set back to form front and



Figure 18. View of the residential cluster

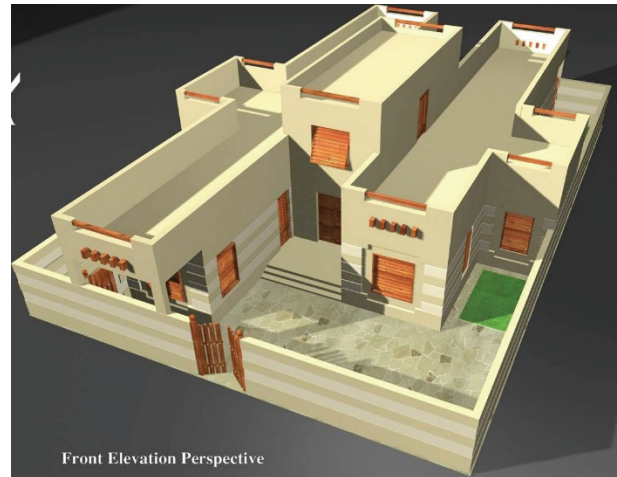


Figure 19. Ground floor plan

back courtyards (type B of project 1 and type I of project 2) gives a higher respect to the sustainability principles compared to the first example. If we look at the third type (type C of project 1) we find that floor plans utilized the entire depth of the plot without set back to form smaller courtyards along the longitudinal axis of the plan in different locations. This type attained the highest level of respect to sustainability principles compared to the other types.

The house of type C is a strip of alternating plans and courtyards. The house is conceived as a linear multi-courtyard house with extended circulation through connecting passages along the courtyards. The house is characterized by long views through the house and a varied daylight effects. This approach coincides with the idea of Serge Chermayeff of the linear courtyard house. He increases the privacy within the house when each courtyard relates to a particular part of the dwelling.

Separating the different parts of the house, noise could not pass from one court to the next [16]. At this point we can argue that type C represents an ideal model that expresses the key design principles and guidelines that could be followed in dealing with the issue of courtyard



Front Elevation Perspective

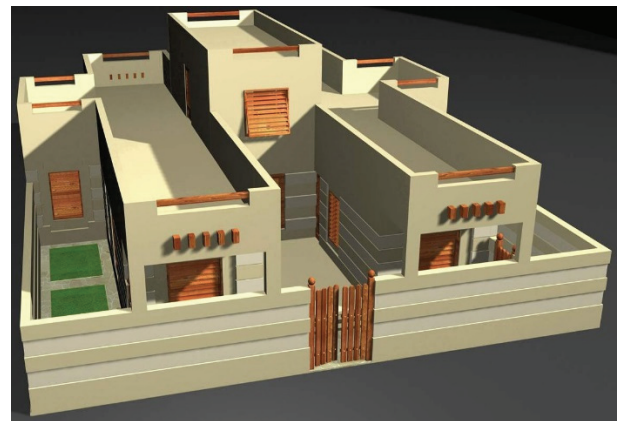


Figure 20. Views of the house showing the front and back courtyards

in contemporary residential building in the region. At the sustainability level, this type gathers and distributes natural lighting very efficiently in addition to offering plenty of natural ventilation opportunities. It also leads to a cheaper and more efficient system of land subdivision and providing service and infrastructure for urban areas. In case of attaching the houses from three sides the facades construction cost is reduced by 50%. Adopting this model helps in the densification of our cities, avoidance of unnecessary sprawl and the availability of more resources resulting from savings in the cost of transportation, in maintenance cost, and in the use of non-renewable resources. Accordingly, in a country like Egypt which suffers from all of the previous problems, it is essential to adopt this model in the housing projects in the new urban developments.

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