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Implications of stereotype mosque architecture on sustainability

Tayyab Ahmad[a*], Muhammad Jamaluddin Thaheem[a], Amad Anwar[b], Zia ud Din[c]

[a] *Department of Construction Engineering & Management, National University of Sciences & Technology, Islamabad, Pakistan*
[b] *Department of Architectural Engineering and Design, University of Engineering and Technology, Lahore, Pakistan*
[c] *Del E. Webb School of Construction, Arizona State University, Tempe, Arizona, USA*

Abstract

Stereotypical construction of buildings, however convenient, poses its own set of challenges. It affects the sustainable development critically and can give rise to social, economic and environmental problems. In other words, same design of a building if repeated irrationally from one place to another even within an identical climatic region gives rise to some grave problems which can compromise multiple dimensions of sustainability. Mosque architecture has some elements that have gradually become its identity. In this research different elements of repetition i.e. stereotype features in mosque architecture are explored. While using a case study approach this research is used to assess mosque projects in an urban region of Lahore, Pakistan. While considering the case studies the positive and negative effects of stereotype elements on three dimensions of sustainability are investigated.

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Keywords: Stereotype; Mosque; Sustainability; Symmetry

1. Introduction

Mosques are found to serve as centre for divine services as well as Islamic spirit and rituals. Among Muslim community it is usual practice to build mosques that not just meet ultimate requirement of *Salat* (prayer) but also some other religious and social services. Consequently, while serving as essential part of Muslim establishments, mosques act as symbol and impetus of Islamic way of life. Aside the principal social and religious purposes, a mosque also embodies the identity of a community [1]. Mosque features have undergone transition from the first mosque in Medina to those of today and in this transition there has been a considerable addition of components with austerity and modesty fading away. First mosque that was established by Prophet Muhammad and subsequent ones during the time of four Caliphs acquired some significant characteristics i.e. being simple and austere; having no

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extravagant or monumental appearance; having no ornamentation or superfluous elements; being active and busy with different rituals, religious education, *dawat* (religious preaching/evangelism), service of mankind; acting as platform of equality, unity and brotherhood; acting as centre for all personal and social aspirations and manifesting the iconoclastic and egalitarian principles of Islam. Besides the mentioned features, there were also some other common features such as defined orientation (towards *Qibla,* direction to be faced when offering prayers); possessing specific architectural features to mark the transition from secular to spiritual and also the clarity and transparency of space [1].

Stereotype is generally defined as a widely held but fixed and oversimplified image or idea of a particular type of person or thing. In buildings, stereotype design is generally meant to give the notion of design repetition and consequently in this research, stereotype mosque design is defined as the one which has all or some of the design elements with cultural rather than functional, religious or utilitarian significance. For mosques there are many design elements comprising of domes, vaults, arches, minaret, *mehrab* (semicircular niche in the wall of mosque that indicates the Qibla), *minbar* (a podium or pulpit in the mosque where the prayer leader stands to deliver sermons) as well as courtyard, verandah and main prayer hall. From these elements some have their deep rooted functionality as also demonstrated by mosques from the earlier periods of Islam, while the rest of elements, though with little or no religious significance, have become the elements of repetition and give rise to stereotype architecture.

Sustainable development which is informing the conscious drive to construction these days needs to be regarded in all building types. The repetitive use of same elements from mosque to mosque can have both the positive and negative effects on sustainability. Primary goal of this research is to start a debate on the implications of stereotype mosque architecture on sustainable development. The objectives of this research are to investigate how the various elements related with stereotype designs of mosques affect sustainability and by which extent.

2. Literature Review

2.1. Mosque and its evolution through time

The original concept of mosque in Islam is that of simplicity with major focus on functionality of space i.e. performance of prayer and other religious rituals. According to Michell [2] if defined in simplistic terms, mosque is basically a building established about a single horizontal axis. This axis termed as Qibla invisibly moves down the middle of floor. After passing from the far wall, it eventually terminates in Mecca, Saudi Arabia. If reduced to basics, mosque is no more than a wall at right angle to Qibla axis and behind or rather before that wall, there can be anything. On ground basis a modest projection of mosque is outlined by Islam as Prophet Muhammad himself is recorded as saying, 'Wherever you pray, that place is a mosque" [3]. From Islamic view point the basis of architecture should encompass Islamic concept of prostration which can be in form of a design integrated with the natural environment as a symbol of devotion to the God's existence [4, 5]. In mosque design space function and elements have much importance with main reference originating from Prophet's Mosque [6, 7] known these days as Nabawi Mosque in Madinah, Saudi Arabia. This mosque includes space function and elements such as building orientation to Qibla direction; prayer hall; mehrab; minaret; minbar; main roof design; ablution area; verandah and entrance gate [4].

The problem with modern mosque design is that it implies disingenuous appreciation of architectural beauty as designs sometime are found to render self-pride and arrogance over the contextual environment. Such practices disregard the concept of prostration. The basic tenets of Islam discourage people from crossing the limits. Therefore the integration of aesthetics in building design with the surrounding context is indispensable which can augment the act of prostration and can aid the development of faith in believers [4]. With ornate and enormous mosques starting to materialize in Islamic architecture in recent times, some typical characters, though inconsistent to doctrine, also developed which include colossal scale, addition of minaret as a symbol of power and majesty; stress on visual aspects by sophisticated and classy ornamental design, glamorous materials; infrequency in use - merely for prayer which is a clear drift from the fundamental objective. However, adherence to some physical parameters like defined orientation is still observed in the mosques of later period [1].

The architecture of mosque upon the spread of Islam is majorly influenced by regional and cultural diversity and yet the grandeur in mosques is also to produce feelings of awe. One of the core assumptions is that a common and frequent emotional response on perceiving instances of religious monumental architecture is and always has been awe. Although grand natural scenes are perhaps among the most widely known elicitors of this emotion, it is very likely that case of religious monumental architecture that have a comparable splendor and grandeur are also able to spark feelings of admiration [8]. Awe is, for example, experienced by heritage tourists upon visiting cathedrals [9], and height, which often is characteristic to religious monumental architecture, has also been found to provoke feelings of wonder and respect in individuals. Also triggering this particular emotional response supports the community function of religions.

The state of Pakistan created in 1947 had mosques in its plans. Similarly, in the states of Indonesia and Malaysia, states acted as prime client. According to Holod et al. [10] these countries consisting of heterogeneous populations opted to utilize building of state mosques in particular as an element to establish their own identity. Mosques had been playing the role of establishing identities of countries in Islamic world the same way as a democratic state is identified by its parliament building as Khan [11] also enlightened: "…the convergence of tradition and modernity in the Islamic world has provoked a wide ranging debate on the essence of Islamic design. This, in turn, has led to a global reassessment of Islamic heritage and culture, and the question: what constitutes Islamic design? The mosque, as the most important architectural representation of Muslim identity, has come to centre stage."

2.2. Stereotypes

The development of theory regarding the presence of two special frames of reference that are believed to influence designers was examined by Powell [12]. One of them is termed as *Known Stereotype Reference Frame* and the other identified as *Primary Generator Reference Frame* [13]. The Stereotype Reference Frame enables a fund of relevant stereotypes to be drawn from designer's own experience. Therefore, it appears that the notion of a stereotyped design trait is both recognized and practiced. This supports the argument that design, in case of certain building types, is in many respects predictable [14].

The disseminated design activity model comprising of generation, synthesis and evaluation is probably not practiced as widely as claimed. The implication is that if it were, more suitable solutions to design issues would have resulted. The act of stereotyping in architecture can be associated with some drawbacks not kept in consideration. It can be stated that self-imposition of a familiar idea or in other words the act of stereotyping results in stylizing design, rather than encouraging innovation in architecture [14-16].

The repetition of themes and designs has problems of its own and there can be ways to solve these issues. It was highlighted by Harper [17] that among some clients and designers there was a tendency to be biased prematurely towards a particular solution and hence only one design was considered. Harper asserts that prepared on same basic assumptions there should be several designs, comparison of which might lead to important and useful aspects. This way instead of a single design being envisioned, several might act on criteria of a feasible solution [14].

2.3. Sustainability

Sustainable development is continuously being emphasized all over the world as it results in conscious efforts in building construction industry which saves the planet from pollution and help develop structures which are economically viable and socially feasible.

To help understand and assess sustainability a hierarchy is developed comprising of three sustainability dimensions that are divided into indicators that are further divided into parameters. From published literature, some dimensions, indicators and parameters of sustainability are identified as shown in Table 1. This hierarchy is prepared by using multiple studies from which one important study is that of Shen et al. [18] which considered construction projects throughout their life cycle starting with inception and ending at demolition. Key performance indicators (KPIs) for assessment of sustainable intelligent buildings prepared by AlWaer and Clements-Croome [19] are also

included in this compilation as they too have their role in whole life cycle. In case of environmental sustainability dimension the indicators and parameters largely have origins from Science Advisory Board (SAB) study [20].

Table 1. Dimensions (D), Indicators (I) and Parameters (P) of Sustainability

<table>
<tr><td>D</td><td colspan="4">ENVIRONMENTAL</td><td colspan="2">ECONOMIC</td><td colspan="2">SOCIAL</td></tr>
<tr><td>I</td><td>Climate Change</td><td>Emissions</td><td>Water efficiency</td><td>Depletion of Resources</td><td>LCC values</td><td>Affordability, Manageability & Adaptability</td><td>User comfort and safety</td><td>Functional, Aesthetic & Innovative design approach</td></tr>
<tr><td rowspan="8">P</td><td rowspan="8">Global warming potential</td><td>Acidification potential</td><td>Rain water use</td><td>Land use</td><td>Capital Cost</td><td rowspan="3">Adaptability & flexibility of building</td><td>Indoor environmental quality</td><td>Usability, functionality & aesthetic aspects</td></tr>
<tr><td>Inert waste to disposal</td><td rowspan="5">Potable water use</td><td rowspan="2">Depletion of material resource</td><td rowspan="6">Life Cycle Cost</td><td>Health and well being</td><td rowspan="2">Innovation & design process</td></tr>
<tr><td>Hazardous waste to disposal</td><td>Safety</td></tr>
<tr><td>Eutrophication potential</td><td rowspan="3">Depletion potential of fossil fuels</td><td rowspan="2">Affordability and economic performance</td><td>Open space availability</td><td rowspan="4">Architectural considerations, integration of cultural heritage & compatibility with local heritage values</td></tr>
<tr><td>Smog potential</td><td>No. of facility users</td></tr>
<tr><td rowspan="2">Ozone Depletion potential</td><td rowspan="2">Manageability aspects of building</td><td>Community amenities provision</td></tr>
<tr><td>Accessibility</td></tr>
</table>

3. Methodology

The methodology employed in this research is that of case study. Since one of the most important elements that affects mosque design is its Qibla direction (which is a design requirement and not a stereotype element) so while considering this in the case studies mentioned below of different mosques in different neighborhoods of Lahore, it is attempted to establish a relationship among stereotype design, ratio of available area to developed area and the angle between Qibla direction and longer length of rectangular property areas. Moreover, an attempt is also made to understand the economic burden of ensuring social sustainability in mosque architecture. The case studies are divided into two parts. In first part four mosque projects are discussed that are in different stages of construction and in second part two mosque projects are discussed that are in design and tendering stages.

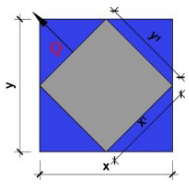
3.1. Case Study-1:

Case study-1 comprises of four different mosques in different stages of construction in different neighborhoods of Lahore, Pakistan. All these four mosques are developed by one client and are designed by a single consultancy firm. The interview conducted with consultant has revealed some significant findings regarding the mosque buildings as well as the sustainability aspects considered or should be considered in their design.

Symmetry about a central axis has become an important element in mosque architecture and is repeated from mosque to mosque, hence can be considered an element of stereotype design. Table 2 is synthesized to show different features of four mosque projects from different neighborhoods that are somewhat based on stereotype design. First three mosques are comparable as the relation among the dimensions of property is same for all these cases i.e. y>x. In case of these three mosques, it appears that with decrease in the difference of Qibla angle from longer side of property, there is an increase in developed area to available area ratio. However, there is an anomaly

in case of Sector-A mosque: the site is such that x>y. As there are no other cases where x>y, so a correlation cannot be established in this case.

Table 2. Different mosque features to demonstrate interdependencies

Mosque Name	Available Area	Mosque Ground floor area i.e. Developed area (Sq.ft)	Difference of Qibla angle from longer side of property (Degrees)	Property line and construction line relationship		Developed area to Available area ratio (the closer to one the better)
Sector-L Mosque	30,400	20,200	3	$y>x$; $y^1>x^1$		0.664
Sector-A Mosque	36,490	17,480	52	$y>x$; $x^1>y^1$		0.479
Sector-P Mosque	24,550	11,090	78	$y>x$; $x^1>y^1$		0.452
Sector-C Mosque	25,000	11,300	26	$x>y$; $y^1>x^1$		0.452

It is apparent from this study that the design of mosque is a function of Qibla direction and in case the available site is not aligned with Qibla direction, some to large waste of land is probable (while the symmetry in design-stereotype character is followed) as discussed in Table 2. It is important to see which parameters of sustainability are affected due to land wastage resulting from stereotype design.

The symmetrical development of mosque in a plot area not aligned with Qibla reduces the developed area which decreases the negative environmental impacts associated with construction materials. In this case of reduced development area, environmental sustainability indicators of climate change, emissions as well as resource depletion will perform better; the economic sustainability indicators of life cycle cost as well as affordability, manageability & adaptability will perform well while there will be a negative effect of this reduced development on social sustainability dimension as the parameters of community amenities provision and number of facility users will be seriously compromised which are actually very important parameters in mosque architecture.

Table 3. Probable decrease in construction cost of mosques by eliminating aesthetic elements

Mosque name	Engineering estimate (Million PKR)	Percentage decrease in project cost by eliminating…		Overall possible percentage decrease in cost
		Structurally redundant elements i.e. domes, arches and vaults	Other aesthetic details that differentiate mosque from other buildings	
Sector-L Mosque	90	20	15	35
Sector-C Mosque	60	18	14	32
Sector-A Mosque	90	20	15	35
Sector-P Mosque	60	18	14	32

For different mosques in case study, a tentative economic analysis is performed as shown in Table 3. This analysis is prepared to exclusively show the costs that relate with cultural elements in mosques that distinguish them from any ordinary building. It is apparent from findings that even while satisfying a social sustainability indicator as user comfort, some marked decrease in construction costs, ranging from 32% to 35% can be ensured by eliminating structurally redundant elements i.e. domes, arches and vaults as well as other aesthetic details that produce a distinction among mosque and any other building type. Hence, it is safe to conclude that a huge percentage of 32% to 35% of construction cost of mosque buildings is associated with social sustainability parameter of aesthetic aspects and parameter of architectural considerations, integration of cultural heritage & compatibility with local heritage values. In other words, this is also one of the direct economic burdens of stereotype mosque architecture that on one hand affects social sustainability dimension positively but other dimensions negatively.

Feedback of consultant is obtained regarding attention paid to three dimensions of sustainability in case of four mosques. Table 4 shows that maximum consideration for mosque projects is given to social sustainability dimension. Such huge consideration justifies the huge portion of construction cost (32% to 35%) accounted for

culturally demanded elements in a mosque. Least consideration is in case of environmental sustainability and a medium level of consideration is given in case of economic sustainability dimension as according to consultant the budget decided by client in case of these four projects is adequately met.

Response from the same consultant was obtained about weights that should be assigned to sustainability dimensions in case of mosque buildings. According to consultant, for mosque projects out of a total weight of 100, social sustainability must have a weight of about 50%. Quite interestingly, economic sustainability dimension was opined to have least value (10%) as the consultant justified that economic issues concern the mosques least and for the environmental sustainability a weight of 40% was given.

Table 4. Consideration to sustainability dimensions in case of various projects

	Sector-L Mosque	Sector-C Mosque	Sector-A Mosque	Sector-P Mosque
Environmental Sustainability (0%-100%)	40	35	35	40
Social Sustainability (0%-100%)	80	85	75	80
Economic Sustainability (0%-100%)	60	60	55	55

3.2. Case Study-2:

Case study-2 is about mosque proposal designs in final stages of design and planning. As shown in Table 5 different proposals of mosque projects are compared with respect to different features. The data is obtained from design consultant involved in architectural planning of these projects. It is found that the consultant prepared one proposal initially to be replicated in two different neighborhoods of Lahore with somewhat similar plot sizes. Both these mosque projects were under the ownership of a single client. The initial proposal prepared by consultant titled as Proposal-2 in Table-5, was strictly stereotype in its spatial planning as it had not only internal symmetry in planning of main prayer hall, verandah and courtyard but also the outer symmetry as its site plan appeared to be symmetrical about the axis along the longer dimension of mosque.

Table 5. Feature comparison of different proposals of mosque projects

Case Study	Mosque Proposal	Available Area	Mosque Ground floor area i.e. Developed area (Sq.ft)	Difference of Qibla angle from longer side of property (Degrees)	Developed area to Available area ratio (the closer to one the better)	Difference in areas of proposals for same project (Sq.ft)
Sector-G Mosque	Proposal-1	16,200	9860	31.49	0.609	1925
	Proposal-2	16,200	7935	31.49	0.489	
Sector-D Mosque	Proposal-1	15,646	9860	31.49	0.630	1925
	Proposal-2	15,646	7935	31.49	0.507	

Mosque architecture mostly promotes symmetrical designs and it is safe to conclude that the stereotype design of mosques has symmetry as one of its key features. Therefore, problems created by symmetrical mosque designs can be considered to be associated with stereotype designs of mosques. To elaborate the negative effect of stereotype design in terms of strict symmetry, another proposal prepared by same consultant for two mosque projects which later on got approved from client is documented as proposal-1 in Table 5. In comparison of Proposal-2, Proposal-1 seems to utilize more of the available space which is because of its somewhat asymmetrical design. This also deviates from the stereotype mosque architecture in locality. Ratio between developed area to available area for different proposals of mosque projects shows that the asymmetry introduced in Proposal-1 which will be repeated in case of both the mosque projects has somewhat increased the land utilization in mosque designs. Proposal-1 is not strictly asymmetrical and has the main areas of mosques oriented towards Qibla, with internal symmetry followed in case of its prayer hall, verandah and courtyard. It still retains some level of symmetry and stereotype approach and

this thing along with difference of Qibla angle from longer side of property (closer to zero the better) has made it a better option as compared to Proposal-2, yet it has a long way to go since developed to available area ratio should be closer to 1 to ensure maximum usability of available land. A visual demonstration of the symmetry followed in two proposals is shown in Fig. 1. For both the proposals, the portion enclosed in red lines is symmetrical about central axis parallel to Qibla direction while the portion in blue lines is asymmetrical, following the constraints set by site and property line rather than Qibla.

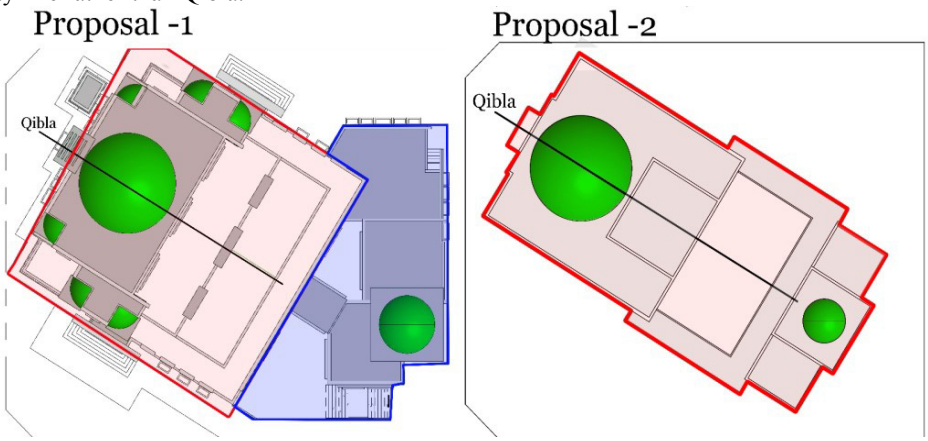


Fig. 1: Proposal-1 and Proposal-2 designed for same site

4. Discussion

From the case study of various mosques located in Lahore, Pakistan many aspects of stereotype mosque architecture are highlighted which affect the sustainable development in one way or the other. The case studies are divided into two portions. In case study-1, four mosques are discussed and the cost of providing stereotype elements i.e. dome, vaults, arches, etc. is found. It is observed from this portion of case study that the stereotype elements on one hand have a positive effect on social sustainability dimension, while negatively impacting the economic sustainability. Moreover, the provision of non-structural and purely aesthetic elements that make mosque architecture stereotype also adds negatively to the overall environmental impact of these buildings as a lot of material is put to use with no regard to cradle-to-grave approach of material resources. The importance given to various sustainability dimensions in case of these mosques is recorded and it is realized that most attention paid by consultant is to the social sustainability dimension.

In case study-2, two different proposals prepared for a mosque project are discussed. Both have different distribution of masses. One proposal which is strictly stereotypical stringently follows symmetry, while the other proposal is a deviation from strictly stereotype approach and introduces some level of asymmetry in building in order to satisfy site requirements resulting in not just an increase in area to be developed but also affecting building sustainability in variety of ways.

It is observed from these case studies that the symmetrical distribution of architectural spaces with Qibla forming the central axis has some problems of its own: it may not always be harmonious with the site requirements. The symmetry which is actually a characteristic of stereotype design results in constraining the building within certain limits. Such constraining results in reduction of area to be developed and as it also affects the prayer area negatively, it affects various dimensions of sustainability in a variety of ways.

The stereotype architecture of mosque is explored in this research by using the case study of 6 mosques under different stages of development. Some elements of stereotype architecture are focused in particular such as symmetry in buildings and aesthetic elements. The effect of these stereotype elements on three dimensions of sustainability is discussed but the positive or negative effects are not quantified as it is beyond the scope of this

paper. For exploring this topic of research further, the quantification of effects of stereotype elements of design is required. Moreover, it is also necessary to determine what the consultants involved in design of various mosques perceive by sustainability in mosques, what weight they provide to three dimensions in mosque architecture and what weight they perceive as ideal for three dimensions.

5. Conclusion

Mosque as a building for performing religious rituals of Muslims is a place of huge significance. Muslim communities commonly have mosques with easy accessibility so that they can perform daily prayers there easily. Mosques though initially simple and functional have now evolved into structures that are also meant to provoke awe. Mosque architecture has grown in some specific stereotype forms that represent culture, tradition as well as regional norms. This research explored some stereotype elements of mosque architecture in details. With the help of different case studies, the stereotype elements consisting of but not limited to symmetry in buildings as well as structurally redundant elements are assessed in terms of three dimensions of sustainability. It is realized that these stereotype elements affect different sustainability dimensions in both positive and negative ways. A tentative quantification of negative impact of social sustainability in case study mosques is provided. Moreover, it is also explored how the stereotype design is affected by difference in angle of Qibla direction from longer side of site being developed. Some recommendations are also provided for further research in this regard which can produce generalizable results.

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