

RETHINKING CEMETERY ARCHITECTURE IN MUSLIM CITIES: A SUSTAINABLE FRAMEWORK FOR VERTICAL BURIAL DEVELOPMENT

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DOI: <https://doi.org/10.5281/zenodo.20662275>

Keywords

Vertical Cemeteries, Muslim Burial Practices, Sustainable Urban Development, Cemetery Design, Land Scarcity.

Article History

Received on 21 May 2026

Accepted on 05 June 2026

Published on 12 June 2026

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Abstract

The unprecedented rate of urbanization in developing countries has been putting pressure on land resources, which has made provision of services in the urban areas, including burial, a great challenge. Traditionally used for ground burial, Muslim cemeteries are experiencing problems of land scarcity, inefficient management, overcrowding and problems with grave identification. Such difficulties have been more noticeable in the more rapidly expanding cities where the growth of the cities has been in direct competition with the allocation of land within the cemeteries. The idea of vertical cemeteries is therefore born, as a possible architectural and planning solution to meet future requirements of burying the deceased with the conservation of precious urban space. This study focuses on the feasibility of vertical Muslim cemetery as sustainable urban burial solution in densely populated urban area. The research is based on secondary data, religious literature, scholarly publications, international case studies, and contemporary practice of cemetery design, and examines the connections between Islamic burial practices and the consumption of urban land, as well as the management of cemeteries and the innovation in architecture. Special consideration is paid to the compatibility of vertical burial methods and Islamic beliefs about death, burial and remembrance. The study also examines models from abroad and examines some of the examples of religious buildings from Brazil, India, the Philippines, Austria, Russia, and Bangladesh to identify design approaches that take into account religious requirements, environmental considerations and urban efficiency. The results suggest that if designed appropriately for religious needs, vertical cemeteries have the potential to use significantly less land, increase accessibility and management of the cemetery, improve its environmental aspects and promote sustainable urban development. The study concludes that vertical Muslim cemeteries are a promising solution for the future, which could be effective in solving the shortage of burial plots while maintaining the values and traditions related to Islamic burial.

INTRODUCTION

Death is a fact of life, and it has always been the case that societies have evolved unique cultural, religious and spatial rituals to celebrate the dead. Of these practices, cemeteries function as sites of memory, identity, spirituality and cultural continuity. Burial grounds have great religious value within Muslim communities, as burial practices are closely linked to Islamic beliefs relating to the soul, the afterlife, accountability before the Lord and the day of judgment. Thus the planning, designing and administration of Muslim cemeteries is not limited to physical structures but is also part and parcel of the religious and social life (Afla & Reza, 2012).

But as cities have growing, new issues have emerged in the traditional model of cemetery development. In many developing countries including Pakistan, Malaysia, Indonesia, a number of Middle Eastern countries, the increasing population and growing densities in cities have majorly shrunk the land available for burial. Cities are expanding horizontally and vertically, with cemetery area becoming limited by competing demands for urban land for housing, transportation systems, commercial development and public facilities. This has led to graveyards being overcrowded, unruly arrangements of graves, problems in finding burial sites, and more worries about the long-term feasibility of traditional burial (Felepchuk et al., 2022).

This is especially important in Muslim communities where cremation is taboo and burial the only acceptable method of body disposal (Shah et al., 2023a). With the growth of population, the need for cemetery land is likely to grow significantly as deaths continue to increase (Sabir & Bhatti, 2025). The traditional way of

burying the dead consumes a lot of land and in many metro areas, land is already being pressed in the cemeteries. The challenge has encouraged scholars, planners, architects and policy makers to find solutions that can meet the requirements of space and religious values (Swensen & Skår, 2019).

A new idea that has come to the fore is the vertical cemetery. Vertical cemeteries are built in several levels to provide for burial, and they have a lower land footprint than the traditional cemetery. Today's vertical cemeteries may seem like innovations, but vertical burial is a tradition that goes back a long way (Shah et al., 2023b). They can be found in such places as ancient Egyptian burial complexes, cave burials, mausoleums, catacombs, and stacked burial systems that have been in use in different cultures for centuries. Today's architectural advances make it possible to implement these ideas in today's urban contexts without compromising dignity, accessibility and environmental sensitivity (Allam, 2019).

The growing verticalization in the context of urban development has introduced a new vision to residential, commercial and institutional architecture (Bhatti & Haq, 2025). The high rise building has emerged as a typical solution to the problem of high population density and of using land effectively (Ahmed et al., 2024). However, although almost all urban sections have adopted the vertical in their planning, the cemetery planning has not changed significantly (Fazal & Bhatti, 2025). The gap causes a relevant question about the future of the cemeteries in the more and more urbanized areas and if the architecture in the cemeteries must evolve with the trend of urban development (Chiodelli, 2015).

There are examples internationally of the increasing interest in vertical cemetery design. The Memorial Necropole Ecumenica in Brazil, the proposed vertical tower burial project in Manila and Mumbai, and alternative redevelopment projects for cemeteries in Europe serve as examples of how architecture for burial spaces can be innovative and respond to the needs of the culture and religions while dealing with land constraints. The developments indicate that cemeteries can be different, they can be functional, usable, accessible, and participatory spaces and they can be sustainable (Cox et al., 2001).

Conventional cemeteries also have environmental issues related to land use, groundwater pollution and urban sprawl (Ahmed et al., 2024). In conclusion, sustainable design of a cemetery is becoming more and more focused on ecological architecture, integration of the landscape, efficiency of resources and stewardship of the environment. Vertical cemetery models not only have the potential to save on land use and maintain green spaces but also provide chances for enhanced management of cemeteries and decreased environmental effects of the traditional way of burying the dead (Cox et al., 2001). However, the use of vertical burial systems is not without controversy in the Islamic environment. All innovations should be consistent with Islamic rules and regulations related to burial practices, the direction of the burial, the treatment of the corpse, and the conduct of members of the cemetery. So, the correlation between religious needs and architectural innovation is a critical factor to understand in the creation of acceptable and sustainable cemetery solutions.

This research examines the possibility of vertical Muslim cemeteries as a sustainable urban planning and architectural solution to the burial issues of the current era. The research is conducted by involving a broad study of religious teachings, studies, cemetery design theories and case studies from around the world in order to assess the viability of embedding vertical burial systems in Muslim societies. Finally, the study is intended to make a contribution to the ongoing discussions regarding sustainable planning of cemeteries, land use in urban areas and the prospects of Islamic burial architecture in cities with high urbanization rates.

PROBLEM STATEMENT

Population growth in cities in developing countries is higher than ever, placing a tremendous strain on the land and public facilities. The consequences of urbanization, one of which has not received much attention, is the lack of burial grounds, especially in Muslim communities where the only acceptable funerary activity is burial. Current Muslim cemeteries are often overcrowded, in poor maintenance, hard to access and lack the ability to meet future burial needs. The expansion of cemeteries in the traditional horizontal direction is becoming more challenging because of limited space, increasing property values and other competing demands for urban development. Despite these difficulties, few studies have focused on cemetery planning in the current debate on urban design and sustainability. Moreover, issues about the appropriateness of other models of burial in the context of Islamic beliefs and cultural norms are also of concern. Therefore, innovative planning strategies for cemeteries are urgently needed to overcome the space constraints while ensuring religious,

environmental and social integrity in urbanizing Muslim populations is a critical need.

RESEARCH OBJECTIVES

Following were the major key research objectives set forth:

1. To examine the relationship between Islamic burial principles, urban land scarcity, and the need for innovative cemetery planning approaches in rapidly urbanizing cities.
2. To evaluate the feasibility and sustainability of vertical Muslim cemeteries as an architectural and urban design solution for addressing future burial space requirements while preserving religious values.

RESEARCH SIGNIFIFCNACE

The importance of this study is that it helps to advance a relatively new, yet poorly researched, area of study that combines such disciplines as architecture, urban planning, sustainability, religious studies, and cemetery management. In spite of the importance of burial sites in human settlements, very little has been directed towards the future planning of burial sites despite the fact that the issue of housing shortage has attracted a lot of research, transportation infrastructure and urban growth management.

The study is instructive for understanding the developmental process of Muslim cemeteries in the context of current urban problems and its ability to meet religious needs. The study explores the possibility of the vertical cemetery model in Islamic contexts, adding to the broader discussion on sustainable land management and innovative solutions for urban design. The results might help the architects, urban planners, city administrators, planners, religious leaders and administrators of cemeteries to build long-term plans for

infrastructure in densely populated cities. Additionally, the study addresses the environmental, social and cultural aspects of the cemetery planning process with a focus on the integration of ecological considerations, accessibility, landscape design and community needs in planning for the future of cemetery development. The study also provides a basis for further empirical studies on cemetery architecture, the vertical burial systems and sustainable urban memorial landscapes in Muslim-dominant countries, especially Pakistan and other fast urbanizing countries.

LITERATURE REVIEW

Burial grounds have long been acknowledged as an integral part of human settlements that serves a religious, cultural and social function, as well as a role in both personal and collective memory. In addition to being places where the dead are buried, cemeteries are also places of cultural and historical value and document the evolution of communities over time. But the cemetery planning has become a major urban issue due to the rapid urbanization, population growth, environmental issues and scarcity in land. These problems are especially acute in Muslim societies where, according to Islam, the disposal of the body is the top priority, so there is a constant demand for land at the cemeteries (Al-Akl et al., 2018). This literature review will explore the combined topics of Islamic belief on death, cemetery management, urban land pressures, the concept of vertical burial, ecological issues and the current practices of the cemetery design.

ISLAMIC PERSPECTIVES ON HUMAN NATURE, DEATH, AND BURIAL

Islamic view of death cannot be divorced from its overall view of human life. Islamic belief is that

man is formed from clay and is given a soul by Allah. Qur'an and Hadiths stress that this world is brief and it is a preparation for the hereafter. The death of individuals is thus not considered to be annihilation, but rather a passage from the physical to another phase of life. Islamic teachings teach that death is a natural fact: a fact that all people must face. Muslim feelings towards life and death are greatly affected by the concept of accountability on the Day of Judgment. The concept of Barzakh, the condition of being interposed between death and resurrection, also strengthens this understanding of a continuation of life after death. The concept of Barzakh, the condition of being interposed between death and resurrection, also strengthens this understanding of a continuation of life after death. In Islam, funeral rites are designed, therefore, to pay respect to the deceased and to prepare the soul for the afterlife (Kazempour & Shokrpour, 2021).

There are strict religious laws to guide the way of Islam in respect to Burial. The dead are washed, wrapped, prayed and buried as soon as it is possible to do so. No cremation is allowed and the body has to be buried with the face towards the Qibla. Islamic funeral rites are simple, dignified and respectful and are usually not elaborate, with extravagant monuments and elaborate memorial structures discouraged. The spatial organisation and design of Muslim cemeteries are directly affected by these religious requirements. Islamic tradition of the permanency of burial poses special challenges in the modern urban context. Muslim communities continue to rely on land-based burial systems, whereas religions that allow for cremation or other methods of disposing of bodies do not. With rising urban population, the availability of

appropriate burial grounds has become more and more a planning priority (Gartiwa, 2013).

CEMETERY MANAGEMENT CHALLENGES IN CONTEMPORARY CITIES

There are a number of studies which have pointed to the problems of cemetery care which are increasing, especially in developing countries. Abdul Rasam et al. (2013) and Ahmad et al. (2015) noted that many Muslim cemeteries have irregular management practices and these can lead to problems in identifying and locating graves, overlapping burials, and inefficient use of land. Inadequate documentation in the cemeteries also makes administration of these cemeteries ever more difficult, and it is more and more difficult to find ancestral graves. The need for land to be used for burial has increased rapidly in many Asian countries, as stated by Daud et al. (2015). The development of housing and business and transport facilities often results in the loss of land for burial. Hence, the challenge for urban authorities is to consider the various land use demands in order to make sure that there are enough burial services to meet the demands of urban residents. The authors in Afla et al. (2018) suggest that there is a need to consider the long term aspects of cemetery planning, which should not be limited to immediate burial requirements, but should also take into account the issue of sustainability, regeneration, accessibility and future demographic trends. If not properly planned, cemeteries can become overcrowded and under-maintained, and isolated from the communities they serve. The problems in running cemeteries do not exist just in Malaysia. The same problems are reported in other parts of Indonesia, Vietnam, Germany and Austria and many other countries. The worldwide patterns indicate that

there is a need for innovative and context-sensitive solutions to the planning of a cemetery, which is a universal challenge in urban life (Iswoyo et al., 2025).

URBANIZATION, DENSITY, AND THE RISE OF VERTICALITY

Modern urban concepts have been extensively developed with regard to the relationship between urban density and architectural form. Limited land and growing population concentrations have spurred cities to grow upwards instead of outwards, as mentioned by Sullivan (2019). Inventors and advances in structural engineering have historically given rise to the skyscraper, a symbol of modernization and technological progress (Mujtaba et al., 2025). Modern urban development is increasingly dependent on the use of tall buildings to make efficient use of space. Living towers, office skyscrapers, mixed-use structures, and institutional buildings are now corporate norms in coping with the challenge of urban development (Nadeem et al., 2025). In addition, Willis (2017) proposes that economies can often influence the form of architecture, leading to the fact that "form follows finance. Although the concept of verticality is adopted in almost every field of urban development, cemeteries are still basically horizontal in their layout. This contrast poses important questions about the future of places of burial in the more and more built-up urban area. Where vertical development is deemed an appropriate alternative for housing, commerce and transportation, it seems reasonable that the same principles can be applied to cemetery design. From this broader conversation on urban density (Khan & Bhatti et al., 2025), the idea of vertical burial was born. The solution is to extend the burial area vertically,

which may help to save valuable land resources and meet future burial needs. These strategies are consistent with modern sustainable development goals of how to use land effectively and minimize urban expansion (Natour, 2013).

MORTALITY, POPULATION GROWTH AND BURIAL LAND CONSUMPTION

The sustainability of conventional burial is related to the trend of the population. Porta (2016) points out that the rate of deaths and population prediction are important parameters to predict future cemetery land needs. With population increases, there is significant demand for burial space even from moderate mortality rates. These statistics show the extent of this problem worldwide. Research on this subject shows that millions of people die each year around the world, which means that if land were buried the old-fashioned way, there would be vast amounts of cumulative land needed. The volume of additional space required for cemetery expansion could become comparable with other uses of the urban landscape by mid century. The projections are especially troubling in countries with high rates of urbanization and little land available. It is possible that traditional burial practices, without the associated innovations of cemetery planning contribute to unsustainable land consumption patterns. As a result, along with the expansion of burial facilities, scholars have increasingly called for alternative solutions that can minimize the spatial requirements of the burial facilities (Gleize et al., 2016).

COMPARATIVE RELIGIOUS PERSPECTIVES ON BURIAL PRACTICES

Burial customs differ from religion to religion. In general, Christianity does allow for the practice of burial, though there are variations in tradition

among the Catholic, Protestant, and Orthodox branches. Overall, Christianity allows for the practice of burial, though there are differences in tradition between the Catholic, Protestant, and Orthodox branches. Cremation is accepted by many Hindus and Sikhs as a favored method of burial, with some differences depending on the region or its traditions. There are differences in this respect between Islam and other religions, because under Islamic legislation cremation is still forbidden. Ground burial has an increased focus on the provision and availability of cemeteries. This separation is important if one is considering using innovative burial solutions. Comparative examination shows that there are varying degrees of flexibility in the adaptation of the funerary ritual in different religious traditions over changes in social and environmental circumstances. But any suggested changes within Islamic contexts should be based on the existing Islamic principles (IBRAHIM et al., 2022). The idea of vertical Muslim cemeteries needs to be examined carefully to see if it can coexist with the Islamic burial requirements, therefore, in what way can architectural innovation be used?

CONTEMPORARY PERSPECTIVES ON CEMETERY DESIGN

In recent times, scholars have begun to view cemeteries as more than a place of sadness; they are areas that are part of the urban fabric. The cemetery is a strong emotional and cultural space that is important for the human personality and for collective memory, says Worpole (2022). Cemeteries have generally been ignored in the context of modern urban planning. Cemeteries are also described as cultural landscapes, which capture historical narratives and demonstrate social change by Francis (2022). The

transformation from churchyard to memorial park is an indication of changing attitudes towards death, remembrance and public space. Increasingly, modern cemetery designs focus on landscape quality, accessibility, inclusivity and environmental sustainability. Some academics propose to include cemeteries in the city's green infrastructure networks, and thus turn them into places of reflection, recreation, and ecological value. These strategies go against the traditional notions about cemeteries as isolated and underused. Jessica Faith Higgins (2018) also states that issues of sustainability, healing environments and community engagement are issues that should be included in contemporary cemetery design. These reintegration projects can restore the cemeteries to a more functional use within urban context and bring back their historical importance as a part of the neighborhood identity (Al-Gabbani, 1991).



Figure 01 Memorial Necropole Ecumenica, Brazil

VERTICAL CEMETERY AS AN EMERGING ARCHITECTURAL TYPOLOGY

With the rising urbanization and limited land availability, architects and planners have explored vertical cemetery designs as viable options to

traditional burial sites. The examples from Brazil, the Philippines, India, Japan and Israel highlight some of the different approaches being explored. A large-scale vertical burial infrastructure can be implemented, as seen in the Memorial Necropole Ecumenica in Brazil. The project allows for thousands of burials in a multi-storey building and minimizes land usage with the addition of community spaces, visitor facilities and chapels, and gardens. Likewise, the "Machine" in Manila and the Moksha Tower in Mumbai look at visions of new connections between density, memory, spirituality and urban life. The projects offer a view on the cemetery that doesn't follow the rule book, but instead ask for an environment that serves multiple purposes and meets cultural and religious needs. The advantages that can be gained from vertical cemeteries are discussed by Hariyono (2020), who pointed out that it will use the land efficiently, provide better access, boost management systems, and lessen the burden on land resources in urban areas. But the installation of the devices is still a hurdle in terms of public acceptance. Vertical burial structures can feel cold and sterile, and are not naturally associated with remembrance or mourning, as seen by critics. As such, the implementation of future vertical cemeteries also hinges on its capacity to retain emotional, cultural and spiritual aspects related to burial practices (Thake, 2016).

ECOLOGY, SUSTAINABILITY, AND CEMETERY PLANNING

There has been a growing emphasis in the cemetery design for sustainability of the environment. Ecological architecture aims at a unity of human actions and nature, and reduces the negative effects on the environment. Old ground burial has been linked to issues of

groundwater pollution, land use and sustainable management of the environment. Under certain conditions, decomposition can leach out fluids and chemical compounds which can have an impact on neighbouring ecosystems, as the UK Department of the Environment (2017) states. Decomposition processes can be contained in controlled structures, as is done in vertical cemeteries, potentially lowering such risks (Ural, 2025).

SYNTHESIS OF LITERATURE

From the literature reviewed, it is apparent that there are a number of important points that run parallel: the need to increase the density of cities, the rising demand for burials, limited land resources, environmental sustainability, and the continued relevance of religious traditions. Although traditional cemetery models have been used for centuries, new city conditions require innovative approaches that can meet the challenges of the future. Current research indicates that vertical cemeteries have great potential to save land, optimise management of space, increase accessibility and help to achieve sustainable urban development. But, the successful implementation in Muslim societies needs to be done carefully in order to integrate Islamic principles in the burial, the cultural expectations, environmental aspects, and the architectural quality. It further appears that there is a significant gap in the literature concerning the use of the vertical cemetery concept specifically in Islamic context. This study aims at filling that gap by studying the potentials of sustainable architectural innovation to help develop the next generation of Muslim burial infrastructure in a manner that respects the spiritual and cultural

values that continue to be central in Islamic practices of burials (Daud & Sulaiman, 2014).

RESEARCH METHODOLOGY

RESEARCH DESIGN

The study's design is a qualitative secondary data analysis to examine the feasibility of vertical Muslim cemeteries to address the growing scarcity of land in urban areas and the future need of burials. The research is exploratory and descriptive, seeking to build a full picture of the current issues in cemeteries, Islamic burial norms, principles of sustainable urban development and innovative cemetery design strategies.

A qualitative design approach was deemed to be suitable as the study was for the purpose of interpreting existing knowledge, concepts, policies, religious teachings, scholarly discussion and architectural precedents rather than to generate primary quantitative data. The research is also based on comparative case studies of international examples of cemetery planning and vertical burial structures. In this way, similarities and differences as well as opportunities and challenges of the vertical cemetery development are identified and critically evaluated.

The study is anchored in a thematic literature review, which allows the integration of the results of various disciplines such as architecture, urban planning, environmental sustainability, religious studies, cemetery management and cultural landscape studies. This way, a general picture of the topic is gained and context specific recommendations for future planning of Muslim cemeteries are developed.

DATA SOURCES

The research is based entirely on sources of secondary information, which have been collated from various academic and professional

publications. The secondary data were chosen because of their capacity to outline historical changes, current issues, theories and practices concerning cemetery design and burial customs. Peer-reviewed journal articles, Books and scholarly publications, International conference proceedings, etc. were the major sources used in this study.

DATA COLLECTION PROCEDURE

The data collection process followed a systematic and organized approach to ensure the relevance and reliability of information used in the study. Initially, an extensive literature search was conducted to identify academic publications, books, reports, and case studies related to cemetery planning, vertical burial systems, Islamic funerary practices, urban density, and sustainable architecture. The collected literature was then screened based on its relevance to the research objectives. Particular emphasis was placed on studies discussing:

- Islamic perspectives on death and burial.
- Cemetery management challenges.
- Urban land scarcity and population growth.
- Sustainable cemetery planning.
- Vertical cemetery concepts and applications.
- Ecological and environmental considerations.
- International architectural precedents and case studies.

Following the screening process, the selected documents were reviewed and categorized into thematic groups. Key concepts, findings, arguments, and recommendations were extracted and compiled for analysis. Relevant information from international case studies including Brazil, India, the Philippines, Austria, Russia, and Bangladesh was also documented and examined. The collected data were subsequently organized

into thematic categories to facilitate interpretation and comparison. This systematic procedure enabled the development of a coherent understanding of current cemetery challenges and potential future solutions.

RESEARCH LIMITATIONS

All research investigations have some limitations, as is the case with this one. The study is completely secondary data-driven in which primary data was not collected through surveys, interviews, or field observation. The results are thus subject to the condition of the available and existing literature, and its quality. Secondly, the notion of vertical Muslim cemeteries is not yet fully explored in academic studies and there are not many studies that can be directly compared. There is not a lot of literature available that specifically addresses Islamic vertical burial systems, but rather the general planning of a cemetery. Third, the case studies selected come from a variety of cultural, geographical and religious settings. Although they offer good ideas about innovative approaches to cemetery design, their relevance in Muslim-majority nations might need adaptation in practice. Lastly, there may be differences in religious interpretation of novel methods of burial between schools of thought, regions and scholars. Hence, the findings of this study should be taken as provisional rather than final decisions on religious matters. Even though the limitations exist, the study can serve as a basis for learning about the problems of the present day cemetery and as a basis for making valuable conclusions regarding the potential of vertical Muslim cemeteries in the process of sustainable urban development.

DATA ANALYSIS & DESIGN INTERVENTION

The review of literature and international cases led to an understanding that the traditional burial practices are not aligned to current urban development. These are all contributing factors to the unsustainability of traditional cemetery planning in the long-term. Meanwhile, Muslim societies are also dedicated to the customs of burial that have been entrenched in religious doctrine and cultural traditions. The results of the literature review and case studies are analyzed to understand the potential of vertical Muslim cemeteries to face the challenges of emerging urban cities and still maintain the principles of Islamic burial.

ISLAMIC BURIAL PRINCIPLES AND THE FEASIBILITY OF VERTICAL CEMETERIES

A major issue with the idea of vertical Muslim cemeteries is whether or not these are Islāmic. The literature reviewed showed that Islam gives detailed instructions regarding treatment of the dead, it focuses on dignity, simplicity, burial after a short time, respect for the body of the deceased. The most important conditions of Islamic burial are washing the dead, shrouding the body, performing funeral prayers, burying in the ground and facing the Qibla. Importantly, Islamic teachings forbid cremation and ask for respect in relation to graves. The literature reviewed, however, does not reveal any specific ban on burial inside a vertically constructed building as long as the basic religious requirements are met. Throughout history Muslim societies have been flexible in accommodating architectural forms to local conditions while not compromising on religious principles. In the Islamic world, such elevated burials, catacombs, mausoleums and

tombs have been found in many forms. While it is predominantly horizontal nowadays, evolutionary change in architecture, resulting from changing urban conditions is not unknown in Muslim cemeteries. The conclusions of the findings indicate that the main concern is not to be buried at the ground level or in the vertical structure, but whether the burial process meets with Islamic requirements and dignity of the dead or not. Vertical cemeteries could be an extension of the traditional burial practices if the graves are kept oriented and accessible for visitation and managed as per Islamic norms. Moreover, Islam also encourages the judicious utilization of resources and discourages wastage. The clever use of land can be considered to be in line with the other tenets of the Islamic religion, which emphasize sustainability and the well-being of the community, in highly urbanized settings where land is scarce and burial spaces are a concern. Thus, well-designed vertical cemeteries could meet religious and modern urban needs.

Urbanization, Population Growth, and Cemetery Land Scarcity

Land shortage is a recurring theme in the literature reviewed, and is a major problem in cemetery development around the world. With large population growth rates, demand for housing, transportation, commercial development and public services has all significantly outstripped the limited land available for future burial grounds. This is especially applicable in developing countries where cities are growing at an unprecedented pace. In certain cities it is not possible to expand the cemeteries because of the competing land uses for residential and commercial developments. The larger the plot the more difficult it is to make it available just for the

cemetery. The following literature review explains that the challenge can only be understood through the lens of the demographics mentioned. Under traditional burial conditions, every year millions of people lose their lives, consuming considerable land. Unless innovations are introduced in the traditional approach to developing cemeteries, urban governments could have significant burial space problems in the future. The results show that traditional horizontal burials require a substantial land area and are frequently not very space efficient. Cemeteries occupy valuable space in many urban settings that might otherwise be put to use for housing, public facilities, green infrastructure or economic development. Although cemeteries are vital urban infrastructure, they do not have the same degree of development as other sectors of urban infrastructure. Vertical cemeteries directly confront this problem by developing land upwards, to make the most of the available space. Like residential towers and commercial high-rises, vertical cemeteries make use of multi-level structures to create a massive number of burials in a relatively small area. This could help to save land space and maintain the burial ground for generations to come. The analysis indicates that vertical expansion of cemeteries is a potential strategy to reconcile the competing needs of urban development and provision of cemetery services, especially in high-density metropolitan areas.

Architectural Innovation and the Evolution of Cemetery Design

Throughout history, the design of cemeteries has mirrored the social, cultural and religious beliefs of the time. Traditional cemeteries were frequently situated on the outskirts of settlements where land was more available. The current

nature of urbanization has however altered the spatial relationships and required new solutions to planning of cemeteries. The literature reviewed shows that cemeteries are becoming more and more viewed as multifunctional instead of just a place for burial. Modern cemetery designs feature prayer spaces, cultural areas, ecological elements, and pedestrian walkways and pathways that benefit the entire community. International case studies show that innovative architecture is capable of addressing today's challenges in the field of burial. The Memorial Necropole Ecumenica in Brazil shows the possibilities for vertical cemetery constructions to be able to cover large capacity, integrate public amenities and incorporate landscape elements. The proposed Moksha Tower in Mumbai also involves burial along with environmental sustainability, cultural inclusivity and urban green spaces. The examples indicate that the architectural form of the cemetery can develop in ways that are not traditional, but still maintain its commemorative role. Modern cemetery design considers cemeteries as dynamic and integral pieces of the cityscape, contributing to its quality of life. The study also shows that the human experience is a key factor in successful cemetery design. Public opposition to cemeteries with vertical access frequently relates to issues of anonymity, institutionalization and the lack of emotional attachments that may be felt to be lost with the death of traditional burial grounds. Thus, future vertical Muslim graveyards need to be designed in such a way that it creates opportunities for dignity, reflecting, contemplation, spirituality and social interaction. The emotional and spiritual characteristics that traditionally surround cemeteries can be preserved through the use of

natural lighting, landscaped terraces, prayer spaces, water features, shaded walkways and culturally sensitive architectural language. These design approaches could increase public familiarity and acceptance while providing vertical cemeteries with meaningful spaces of remembrance.

Environmental Sustainability and Ecological Considerations

Sustainable development has become an important aspect of modern urban development. Although the development of a cemetery is a cultural event, it also causes environmental problems in terms of land use, disturbance of the environment and ground water contamination. The literature indicates that conventional burial practices need huge land space which is then to be dedicated for cemetery use for a long period. In urban areas, this can result in urban sprawl and limit the availability of potential alternative land uses. Further, questions have been asked about the effects of the decomposition processes and related burial materials on the environment. There are a number of potential environmental benefits with vertical cemeteries. They greatly save land use by consolidating the burial process in smaller facilities. This opens the opportunity to include surrounding land as parks, ecological restoration, public spaces or future urban development. Secondly, there is a growing trend towards the adoption of ecological architectural principles in modern cemetery layouts. Green roofs, vegetated façades, natural ventilation systems, renewable energy systems, rainwater harvesting, and integrated landscape systems can help improve the environment and provide a better environment for visitors. The Moksha Tower proposal is a significant example of how

cemetery architecture can help promote environmental sustainability. The project is also designed to incorporate the use of vegetation throughout the structure, and minimize the need for land-intensive burial practices, thereby illustrating how memorial architecture can serve to advance broader ecological goals. In addition, the principles of ecological design are closely related to the current sustainability challenges such as resource efficiency, climate resilience, biodiversity enhancement, and environmental stewardship. The future development of a new cemetery where environment and religious needs meet is especially important for these principles. The results, therefore, imply that vertical Muslim cemeteries can be used as burial facilities and not just as sustainable urban infrastructure which positively affects the environmental quality and conservation of land.

Lessons from International Case Studies

The case studies from around the world offer ideas for new models of cemetery planning and design. Even though the contexts are different and cultures, religions and geography differ, there are some common themes. The Memorial Necropole Ecumenica in Brazil is an example of how such infrastructure can be implemented on a large scale. The success of its plans shows the potential for the coexistence of burial plans with public facilities, commercial services and landscaped environments in a single development. In the Manila "Machine" proposal, life and death, memory and urban space are envisioned in a new way. The concept is challenging in the way that it gives a chance for innovative approaches to cemetery integration in dense urban environments, albeit much conceptual. The Moksha Tower proposal includes

a focus on cultural inclusivity and sustainability. How it is able to support several faiths, and how the design can meet the needs of society, while using space efficiently, is a testament to its architecture. Development of the Muslim cemetery at Kirkhlyar, Russia, offers valuable insights in the field of heritage conservation, community engagement and public space integration. The project does not only highlight the role of cemetery as a place of burial but also as a place of social and cultural activity. The Islamic Cemetery in Altach, Austria, is another example of the importance of simplicity, well-designed spatial organization and architectural sensitivity to spiritual identity. The project has successfully integrated the practical with the spiritual, making a space for remembrance that is fitting and dignified. Together these case studies illustrate that there are other ways of innovating cemeteries apart from verticality. Planning a cemetery is a complex process that involves considering religious considerations, sustainability, architecture, culture and community needs.

DISCUSSION

The first research objective aimed to explore the correlation between the principles of burial in Islam, the scarcity of land in urban areas, and innovative planning techniques of cemeteries. The analysis corroborates the fact that urbanization and the scarcity of land are causing serious constraints on traditional Muslim burial systems. Meanwhile, burial needs for Muslims require continued availability of burial grounds. This situation calls for creative good planning approaches which have a religious dimension. The second research objective was the feasibility and sustainability of the vertical Muslim cemeteries. The results suggest that vertical cemetery

development has significant benefits for conserving land, optimizing management processes, promoting environmental protection, and future capacity. Although problems of public perception and religious interpretation still exist, available evidence suggests that vertical Muslim burial grounds have a potential solution to the emerging problems of urban burial that are viable and sustainable when they are designed according to Islamic values. Overall, the analysis has shown that the future of cemetery planning in Muslim societies could hinge on the capacity to accommodate traditional religious values and a creative architectural and urban design approach. Vertical cemeteries are one such alternative, and a way forward for more sustainable, efficient, and resilient burial infrastructure for fast-growing urban areas.

SUMMARY OF FINDINGS

The results of this study are based on the analysis of secondary literature, religious sources, current cemetery planning approaches and selected international case studies. The results are reported in the context of the research goals and give insights into the feasibility of vertical Muslim cemeteries as a sustainable urban burial solution. The study concluded that the amount of land available for the traditional approach to expansion of a cemetery has declined greatly because of the effects of rapid urbanization, population growth, and the rising value of the land. Cemetery development often clashes with built-up areas in urban settings, as well as with commercial developments, transport facilities and public services, which represent a challenge for providing for burial in the long term. The analysis identified that traditional ground burial patterns use up huge land resources and have low potential

for expansion in densely populated urban areas. This is likely to become more acute with future demographic growth and many of the existing cemetery models will be harder to maintain. Based on a review of Islamic teachings, the most critical things that need to be taken into consideration during Muslim burial are dignity, body orientation, timely burial and respect for the dead. When these core principles are adhered to, the literature does not show a clear restriction of religious beliefs with respect to a vertically organized burial system.

Experience from abroad shows that vertical cemetery buildings can be used for burial densities significantly greater than would be possible in a horizontal structure in the same size of area. This method is a useful way to conserve land in urban areas while still providing for future burials. The study identified that the vertical growth approach has become a common part of residential, commercial and institutional developments, but there is not much change in the planning of cemeteries. The disparity underscores the need for innovation in the infrastructure of burials to meet the challenges of the modern urban environment. The results indicate that vertical cemeteries can be a viable approach towards sustainable urban development, by minimizing land use, preserving open space, incorporating GIs, and providing scope for ecological architectural interventions. These benefits support the wider environmental sustainability goals. It was found that public opposition to vertical cemeteries is frequently associated with aesthetic, emotional and an apparent loss of traditional cemetery character. Memorial environments that are well designed with landscape, prayer spaces, natural lighting and culturally-sensitive architecture are more likely to

be accepted by the public. The case studies in Brazil, India, Austria, Russia, the Philippines and Bangladesh show how innovative cemetery planning solutions can effectively tackle issues and concerns of land limitation, accessibility, heritage protection and environmental sustainability. These examples illustrate some of the lessons that could be learned for future Muslim cemetery developments.

The research revealed that modern cemetery design is more likely to include public facilities, green spaces, communal spaces and ecology. This integration makes cemeteries more than just places of burial; it makes them part of the city, part of the culture. The overall results suggest that vertical Muslim cemeteries also have significant potential to become a solution for the growing need to bury people in the rapidly urbanizing cities. Vertical cemetery development offers a potential solution for balancing the religious requirement, environmental concerns and efficient use of urban space through sustainable design principles and community needs, when implemented in accordance with Islamic principles.

To sum up, the findings support the idea that the problem of cemetery land shortage is now an increasingly large problem in urban areas. The evidence also indicates that vertical Muslim cemeteries provide an effective and sustainable solution that can meet future burial needs and maintain the spiritual, cultural and religious values that underpin Islamic burial practices.

RESEARCH CONCLUSIONS

One of the major challenges faced by the cities in the modern era is the pressure on urban land resources. Although much focus has been placed on housing, transportation, and infrastructure,

providing burial space has not been as prominent within urban planning conversations. The aim of this study was to examine the possibilities of vertical Muslim cemeteries in solving the problem of increasing lack of cemetery land for growing population in cities, especially in fast growing urban cities where traditional burial grounds are close to reaching their spatial limits.

The research results clearly show that the problems of planning cemeteries are growing more complex as a result of population growth, urban expansion, the increasing values of land, and the environment. Traditional models of cemeteries based on horizontal development of land are becoming more challenging in highly populated urban areas. The sustainability of current burial methods is a matter that needs to be seriously rethought as land is becoming scarce.

The study also finds that Islamic burial requirements are not incompatible with creative solutions to spatial arrangements aimed at enhancing land use efficiency, as they are also based on the values of dignity and simplicity, with the deceased being respected. The basic tenets of Islamic burial continue to focus on the correct treatment of the deceased, the Qibla, and burial according to Islamic beliefs. Therefore, vertical cemetery systems can be deemed to be compatible with Islamic values as long as these key requirements are adhered to during the design, planning and operation stages.

The literature and case studies review show that vertical cemetery development is a practical solution to the problem of land shortage and is gaining considerable interest in the world. Case studies from Brazil, India, Austria, Russia, and the Philippines show how cemetery design is advancing from the traditional and embracing

sustainability, multi-functional spaces, ecological design elements and enhanced visitors' experiences. It is through these developments that the potential of burial infrastructure to be flexible in adapting to shifting urban contexts and its cultural and spiritual value is evident.

The other key finding of the research is the influence of the architecture on the public acceptance of innovative burial solutions. Vertical cemeteries cannot simply be seen as containers for the dead but as significant memorial environments that facilitate the act of remembering, spirituality, reflection and participation in a community. Enhancing the social and emotional aspects of these developments can be achieved by incorporating landscape features, prayer spaces, open spaces, natural light and culturally sensitive design.

In terms of sustainability, the study findings show that vertical Muslim cemeteries have significant benefits in regard to land saving, environmental protection and urban efficiency. Vertical cemetery developments can help alleviate the burden of the physical infrastructure of cemetery use and allow for the conservation of land in the cities for the benefit of future generations while furthering sustainable urban development goals.

Finally, this study demonstrates that vertical Muslim cemeteries are a realistic and future planning solution that could be implemented in highly populated cities to meet future burial needs. The concept has a great potential as a new and sustainable and culturally appropriate solution for the future of Muslim cemetery planning, even though additional empirical studies, consultations with stakeholders and religious dialogue may be required to facilitate the implementation. As such, the study can be

incorporated into the growing conversation around sustainable burial facilities, and the need to blend religious ideals, architectural innovation and urban sustainability into future cemetery development schemes is brought to the fore.

RESEARCH FUTURE DIRECTIONS

A number of recommendations have been suggested in the light of the results of this study and the conclusions arrived at for the future planning, design and management of Muslim cemeteries in rapidly urbanizing environments. Urban planning officials should consider the development of the cemetery as a component of long-term planning processes, and acknowledge that the cemetery is a true urban service that is as important as housing, transportation, healthcare, and education. Burial requirements shall be estimated by the demography and mortality statistics for future generations and provide for provision for future cemetery requirements. Pilot projects should be promoted for the implementation of vertical Muslim cemeteries that can determine the operational efficiency, public acceptability, economic and environmental suitability of implementation. Any further vertical cemetery development should strictly adhere to the Islamic principles of burial, with the guidance of Islamic scholars, local community and relevant parties, to guarantee the religious legitimacy and social acceptance of such development. Environmental performance needs to be maximized by implementing sustainable architectural solutions such as green roofs, integrating landscape with architecture, rainwater harvesting, passive environmental design, renewable energy systems and environmentally responsible construction materials. Cemeteries must also be transcended to be used as cultural

and community places, through the creation of landscaped gardens, shaded pathways, prayer facilities, seating areas and reflective spaces that meet the emotional and spiritual needs of visitors to the cemetery. In addition, digital cemetery management systems based on Geographic Information Systems (GIS), digital mapping technologies, online databases and other digital tools should be implemented to enhance record-keeping, identification of graves and operational efficiency. Cemetery planning, Islamic burial architecture, sustainability and public perception of vertical burial system should be studied by multidisciplinary institutions of universities and research institutions to assist decision making based on evidence. Cemetery design guidelines also need to be created by the national and local authorities, taking into account religious needs, sustainability goals, accessibility, landscape quality and urban integration, in line with the specific context in which they are built. Throughout the planning process, public awareness building and community engagement should be integrated into the process to overcome misunderstandings and promote community acceptance of innovative solutions for the cemetery. Last but not least, policy makers should acknowledge the potential of vertical cemeteries to be a key element of sustainable urban development that can meet religious commitments, environmental care, and efficient land use. The successful implementation of such initiatives will require collaborative efforts among planners, architects, policymakers, religious scholars, environmental experts, and local communities to ensure that future cemetery developments effectively address urban land scarcity while preserving the dignity, spirituality,

and cultural significance of Islamic burial traditions.

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