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Crystallizing Poetry in Sustainable Architecture: Humanitarian Impact, and Mystical Influence of Rumi

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Crystallizing Poetry in Sustainable Architecture: Humanitarian Impact and Mystical Influence of Rumi

Sürdürülebilir Mimaride Kristalleşen Şiir: Mevlana'nın İnsani Etkisi ve Mistik Etkisi

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Abstract:

Mysticism and architectural art are closely connected, reflecting human existence by portraying cultural, spiritual, and social identities. The Iranian American architect Nader Khalili was not only a theoretical architect, but he also addressed human needs through architecture, drawing inspiration from the thoughts and poems of Rumi. He incorporated elements from Rumi's Masnavi in his remarkable work for various purposes, either explicitly or implicitly, intentionally or unintentionally. This connection is evident in his effort to inform the architectural world in which he lived, use imaginative architectural forms in his speech, establish a link between architecture and existence, and present broad ideas that can be applied to architecture. By inviting people to remember God through architecture, he sought to explore the concept of creationism in architecture through Rumi's thoughts. Iranian American architect Nader Khalili transformed sustainable architecture with his innovative earthbag construction system, "Superadobe." This system was created to provide affordable housing in distressed areas. Inspired by the poetry and philosophy of Rumi, Khalili's work emphasizes the connection between architecture, humanity, and spirituality. This article explores Khalili's approach, its philosophical links to Rumi's Masnavi, and the global impact of his designs. By addressing the human and architectural aspects of existence and their intersections, Khalili's adobe structures contribute to philanthropic housing and provide insight into the fusion of tradition with modern knowledge. Case studies demonstrate the resilience of these structures in the face of natural disasters and their role in sustainable and culturally relevant design.

Keywords: Earthbag construction, Superadobe, Sustainable architecture, Rumi, Masnavi, humanitarian design, Nader Khalili.

Özet:

Tasavvuf ve mimari sanat yakından bağlantılıdır, çünkü ikisi de kültürel, manevi ve sosyal kimlikleri tasvir ederek insan varoluşunu yansıtır. İran asıllı Amerikalı mimar Nader Khalili yalnızca teorik bir mimar değildi, aynı zamanda mimari aracılığıyla insan ihtiyaçlarına hitap etti ve Mevlâna'nın düşüncelerinden ve şiirlerinden ilham aldı. Çeşitli amaçlar için, açıkça veya örtük olarak, bilerek veya bilmeyerek, dikkate değer çalışmalarına Mevlâna'nın Mesnevi'sinden öğeler dahil etti. Bu bağlantı, yaşadığı mimari dünyayı bilgilendirme, konuşmasında yaratıcı mimari formlar kullanma, mimari ve varoluş arasında bir bağlantı kurma ve mimariye uygulanabilecek geniş fikirler sunma çabasında belirgindir. İnsanları mimari aracılığıyla Tanrı'yı hatırlamaya davet ederek, Mevlâna'nın düşünceleri aracılığıyla mimaride yaratılışçılık kavramını keşfetmeye çalıştı. İran asıllı Amerikalı mimar Nader Khalili, "Süperadobe" olarak da bilinen yenilikçi toprak torba inşaat sistemiyle sürdürülebilir mimariyi dönüştürdü. Bu sistem, sıkıntılı bölgelerde uygun fiyatlı konut sağlamak için yaratıldı. Rumi'nin şiirinden ve felsefesinden ilham alan Khalili'nin

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çalışmaları, mimari, insanlık ve maneviyat arasındaki bağlantıyı vurgular. Bu makale, Khalili'nin yaklaşımını, Rumi'nin Mesnevi'siyle olan felsefi bağlantılarını ve tasarımlarının küresel etkisini inceler.

Varoluşun insan ve mimari yönlerini ve bunların kesişimlerini ele alarak, Khalili'nin kerpiç yapıları hayırsever konutlara katkıda bulunur ve geleneğin modern bilgiyle kaynaşmasına dair içgörü sağlar. Vaka çalışmaları, bu yapıların doğal afetler karşısındaki dayanıklılığını ve sürdürülebilir ve kültürel açıdan ilgili tasarımdaki rollerini göstermektedir.

Anahtar Kelimeler: Toprak çuval yapımı, Süperadobe, Sürdürülebilir mimari, Mevlâna, Mesnevi, İnsani tasarım, Nader Khalili.

Introduction:

Architecture is more than just creating spaces; it expresses human existence. Architecture is deeply intertwined with human experience, reflecting different levels of cultural, spiritual, and social identity. Therefore, it is essential to consider the human aspect in creating architecture. As human understanding of self and existence varies across cultures and contexts, so do architectural interpretations. In Iranian culture, where architecture is historically intertwined with art, religion, and mysticism, the works of Sufi poet Jalaluddin Rumi provide a philosophical foundation for exploring architectural creativity. Rumi's Masnavi provides deep insight into existence, the unity of nature, and the role of creation in human life. Nader Khalili, a pioneering architect, embraced this mysticism in his designs and sought harmony between architecture and the elements of Earth, wind, water, and fire, which played essential roles in both Rumi's philosophy and sustainable construction methods. This article explores the idea that architecture, especially in the context of Iranian culture, art, and religion, should be in harmony with tradition and modern knowledge. In this search, Rumi's mysticism becomes a necessary lens to understand the philosophical foundations of creativity in architecture. Nader Khalili's work developing the earthen bag construction system, or Superadobe exemplifies integrating tradition and modernity. Rumi's thoughts profoundly influenced his architectural philosophy, focusing on the relationship between architecture and human existence.

This article examines Khalili's "superadobe" system, an earthen bag construction method, and how it reflects practical solutions to global housing needs and the spiritual principles found in Rumi's poetry.

How does Nadir Khalili's superstructure construction system reflect the sustainable architecture and mystical principles in Rumi's poetry?

How do Khalili's works show the relationship between Rumi's thought and architecture and help in this understanding?

How do adobe structures perform in disaster-prone areas compared to traditional construction methods?

Methodology

This study uses a hybrid approach to combine qualitative analysis of Rumi's philosophical insights with quantitative evaluations of Khalili's superstructures. Data collection includes case studies of megaclay projects in areas affected by natural disasters, such as Haiti after the 2010 earthquake and Cal-Earth Institute projects. The study analyzes Khalili's architectural writings and theories alongside mystical interpretations of Rumi's Masnavi to examine the conceptual basis of his design philosophy.

Mysticism And Architecture: Rumi's Influence On Khalili

The relationship between architecture and human existence has been the subject of philosophical research for a long time. In the Iranian context, mystical views, especially Molavi, offer a unique framework for understanding this relationship. Rumi's works explicitly and implicitly address architecture, particularly in the Masnavi. His poetic language evokes architectural forms and establishes a deep connection between

structure and the spiritual memory of God. In the context of Iranian culture, Rumi's mystical views provide a unique perspective for understanding architecture. Referred to as the "Quran in Persian," Rumi's Masnavi delves into the metaphysical questions of unity and creation, which are fundamental to architectural thinking. Mysticism, as embodied in the works of Rumi, views creation as a reflection of divine unity, where every element of existence serves to remind one of God (Golkarian, 2023). Rumi's vision extends beyond time and space, offering a universal perspective that Khalili sought to integrate into his architectural designs. In Masnavi, Rumi often used architectural metaphors to describe human existence and the creation process. He saw architecture as a physical endeavor and spiritual expression that could guide humans toward a higher understanding of their place in the universe.

For Khalili, this philosophical viewpoint was crucial. His designs reflect the harmony between humans and nature, mirroring the four classical elements—Earth, wind, fire, and water—central to Rumi's thought and architecture. Khalili's superadobe structures manifest this worldview, offering a tangible form to Rumi's ideas about creationism and existence. A verse from Mawlavi's Masnavi inspired Nader Khalili (Figure 1).

باد و خاک و آب و آتش بنده‌اند　　با من و تو مرده با حق زنده‌اند

"Wind, Earth, water, and fire are slaves."

With you and me, the dead are rightfully alive" (Masnavi, Book 2:2958, verse 839, s. 296)

Figure 1: Nader Khalili's photo next to the innovative Super Adobe method inspired by Rumi's poems (Akhbarsakhteman, 2023)

This passage discusses the connection between natural elements and human creativity in architecture. It highlights the work of Khalili and his use of the superadobe system to create

sustainable, low-cost, and flexible structures. It also compares Khalili's approach to architect Hassan Fathi, who emphasized traditional and earthy architecture for rural and low-income environments. Khalili's work is noted for blending Rumi's spiritual depth with contemporary disaster relief architecture. The text also praises Abrakhsht Khalili Construction for incorporating Rumi's teachings and creating structures that address practical needs while reflecting cultural and spiritual values. It emphasizes that this fusion of mystical insight and architectural pragmatism is a rare study area, making Khalili's work an essential case for sustainable and spiritually conscious design.

In his trips to desert cities and villages, Nader Khalili noticed that desert glaciers, windbreaks, and water reservoirs are still intact after dozens of earthquakes over several centuries. Still, modern buildings with heavy materials such as iron beams cause earthquake deaths. The Tabas earthquake was one of the most shocking images of his life. Many domed and adobe structures, such as animal pens and stables, remained intact, but cement and concrete houses were destroyed (Figure 2).

Figure 2: 40 years ago, the earthquake that leveled Tabas (Khabar Online, 2018)

At age 38, Iranian architect Nader Khalili said goodbye to a prosperous life and urbanism to learn from nature and authentic Iranian architecture and how to build houses for low-income and poor people. The idea of his ideal houses came from arches and domes built in desert villages for hundreds of It was a year ago, and its materials were not separated from climate and environment. He found the secret of this elegance in Molvi's poems: the secret of the strange and beautiful combination of Earth, water, wind, and fire. His shelter architecture method, called Abarakhsht, was welcomed in the United Nations and many countries,

but not in Iran. His designs for building domed and ceramic houses on the moon were proposed, and in 1984, NASA asked him to implement a sample with lunar soil to build a settlement on the moon, but no government in Iran agreed with his ideas (Houben et al., 2008). He said that because these types of temporary housing are cheap, especially during earthquakes and floods, construction companies do not make a profit, all kinds of under-tables are removed, and bullies and intermediaries are left without a share; this is why some officials, including in Iran, do not agree with this type of house building.

The main element in this style of architecture is the arch and dome. You've come a long way if you learn to make a bow. If, for example, you rotate this arch around the center of its section, you will have a domed building. If you lay the same bow on the ground, lift it at a 90-degree angle, and rotate it, you will own half of a domed building (Figure 3).

Figure 3: Construction of a building on the moon inspired by the design of an Iranian architect (Razazchian Baboli & Khanlou, 2015).

One of Khalili's ideas was building adobe or ceramic houses, especially in earthquake-prone areas, with arches, domes, and large skylights. These adobe houses are burned from the inside to become resistant and are melted and glazed like pottery to turn into solid bricks against rain, storms, and earthquakes (Figure 4).

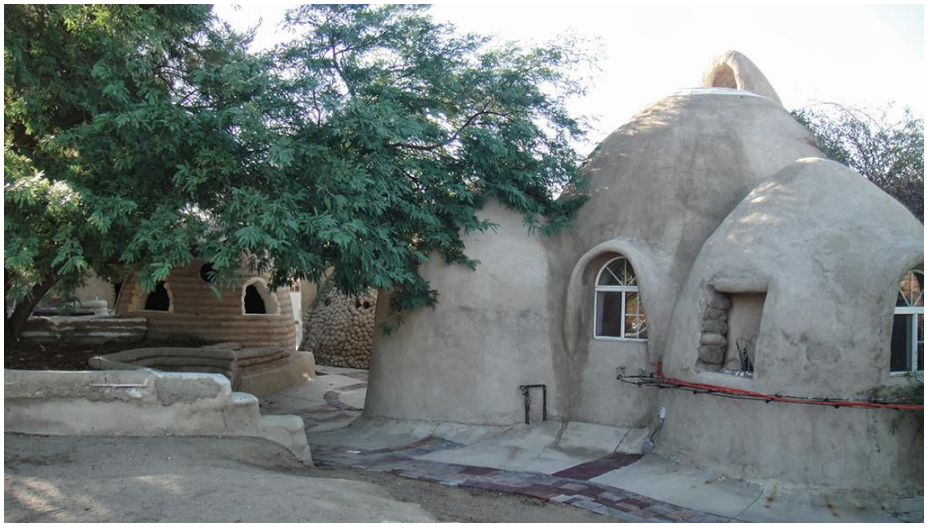

Figure 4: Khalili's adobe or ceramic houses (Bani Massoud, 2008).

His second idea was *"Gel Taften"*. The term "Geltaften" comes from the word *"Gel,"* which refers to a mixture of water and soil, and "Taften," meaning to put and cook. This method aims to strengthen existing buildings, especially traditional mud and clay houses in villages while constructing inexpensive homes that withstand adverse weather, floods, and earthquakes. This technique converts existing, worn-out clay and mud structures on-site into bricks through firing and baking.

Khalili notes that this design utilizes the four elements—Earth, water, wind, and fire—available everywhere and to everyone, blending them to create suitable and beautiful architecture. The *"Geltaften"* method represents a significant advancement that respects and builds on traditional Iranian clay and mud architecture. It effectively combines clay construction with Iranian pottery and is a progressive step in this historical journey (Figure 5).

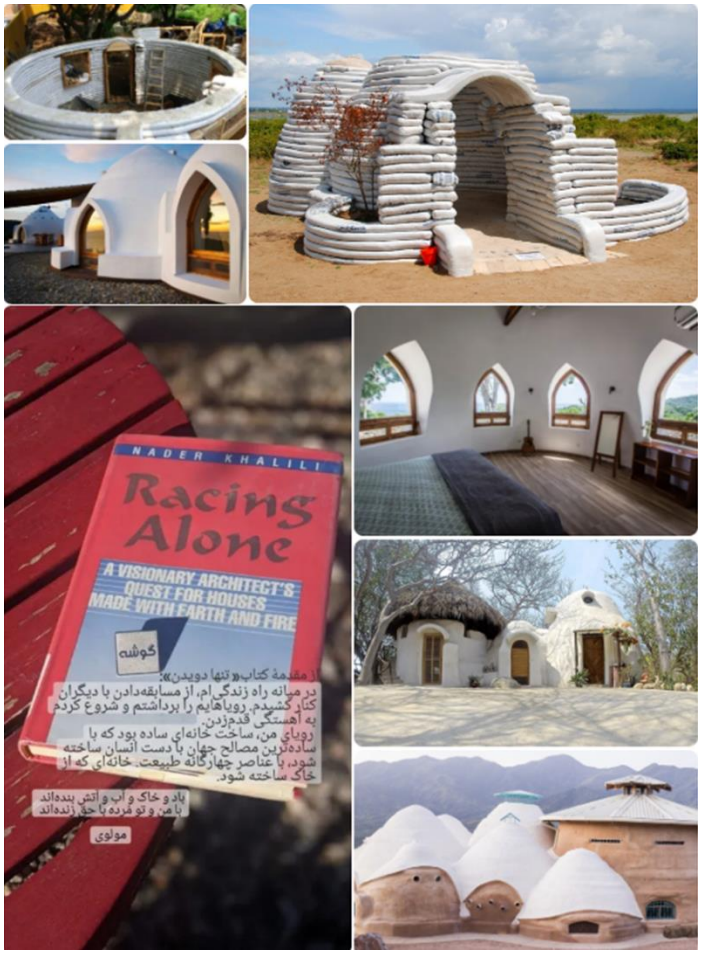

Figure 5: A house of wind, Earth, water, and fire (Azadeh, 2020).

Khalili outlines the results of "smelting" village houses as follows:

1. Existing mud and clay houses with arches can be transformed into brick houses at a minimal cost. Through tufting and baking, the old clays turn into bricks, and the clay mortars also become bricks, resulting in a unified structure.

2. By altering the fundamental form of clay into brick, the material's weaknesses—its tendency to dissolve in water and crumble under pressure—are turned into strengths. This natural response of clay to fire enhances the building's resistance to rain, snow, and earthquakes.

3. This straightforward technique, using torches and locally available fuels, demonstrates that reconstruction is feasible even in remote areas.

4. Once the house is reinforced without fundamentally changing the villagers' living environment, traditional joinery can be done according to their preferences.

5. bathrooms, kitchens, and toilets can be covered with traditional ceramic glaze. After curing, these surfaces can be made into an integrated tiling that is strong, hygienic, and aesthetically pleasing. The process generates enough heat to disinfect the environment, significantly reducing the presence of pests like rats.

6. By sealing the doors and windows of the rooms, each room can temporarily function as a furnace. The raw clay is placed inside, and after being fired and baked, it is transformed into bricks that can be used for

gardening, wall construction, and other purposes. This ensures that a building becomes a productive unit rather than just a consumer of materials (Figure 6).

Figure 6: How to place windows in adobe (Saeed Sun, 2012).

The most significant outcome of implementing this plan, which will significantly impact the reconstruction of villages in the country, is its self-help aspect. Villagers readily accept the "Geltaften" reconstruction method, and upon completing the first house, they learn and adopt the technique themselves, given their natural familiarity with the process. Renovations can be easily carried out during winter when villagers have more idle time. Experts from the Building and Housing Research Center of the Ministry of Housing and Urban Development have confirmed the success of the *"Geltaften"* method, showing its resistance to moisture, pressure, and loads. Surrounding villages serve as living examples; many clay and mud structures that have been fired have withstood snow, rain, floods, and earthquakes for over a century, enduring as solid units.

With tufting, all new rural buildings—from mosques and schools to houses, baths, and stables—can be constructed using clay and mud as the only necessary materials. These can then be transformed into single brick shapes through tufting and baking. Carpentry for these structures employs traditional methods, with areas like bathrooms and toilets glazed and baked (Figure 7).

Additionally, rural houses can be prefabricated and transported using a weaving method. In this approach, a factory, similar to a brick factory, produces complete units designed for building houses. These units come as fully integrated brick rooms (complete with walls, ceilings, and floors) that, when assembled, form a house, school, or other complex.

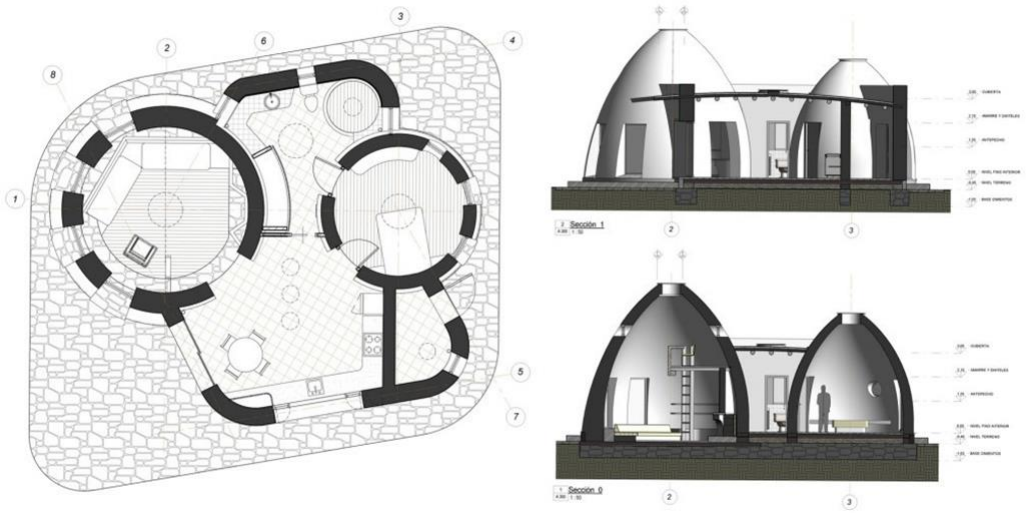

Figure 7: An example of the plan and section of the Goltaftan building (Bani Massoud, 2008).

The Method of Construction Using Earth-Filled Bags

Nader Khalili, a California architect born in Iran, has dedicated his career to being a humanist, lecturer, and innovator in America. He developed a construction system suitable for vulnerable populations, known as *"ceramic houses"* (Houben et al., 2008). This rapid building method is ideal for temporary accommodation for individuals affected by natural and humanitarian disasters. The system consists of vertically stacking bags or strips filled with Earth, derived from military techniques used to secure earthen trenches and construct shelters. In English-speaking countries, this method is called "earthbag construction," where soil is placed in sacks. The filled strips can reach up to 25 cm in height and are arranged in rows, creating a dome shape at the top (Sruthi et al., 2013). The bags can be made from polypropylene or natural materials like jute or hemp. The filling consists of a mixture of clay and sand, similar to the composition used in rammed earth construction (Marjanović, 2010). Earthbag houses are built on low foundations and waterproofed from the ground. Additional profiles are installed, and the structure is built from the outside. Once completed, the building is plastered with either mud or cement mortar on both the interior and exterior (Kristral, 2009). These ceramic houses are considered non-flammable and can be constructed quickly. They typically cover a base area of about 40 m², featuring a central room and additional rooms off to the side, all arranged around a circular base. Khalili continues his research; after extensive studies on traditional Iranian architecture construction methods, he invents the sandbag system (Figure 8).

Figure 8: Clay glacier in the desert, an example of authentic Iranian dome architecture (Azadeh, 2020).

In this system, which results from Khalili's 23 years of research and experience, bags about 30 meters long and 40 cm wide are used instead of mud clay. The basic technique of this method is to make and fill bags with soil and place them in a circular plan. This circular layer accumulates towards the center as it goes

higher and finally forms a dome. Barbed wire is used between these layers to prevent sandbags' movement and resist earthquakes. In this method, materials such as sandbags and barbed wire, usually used for war purposes, are used in peaceful conditions, and traditional architecture is mixed with the soil and safety principles of today's world. This method uses traditional shapes such as arches, domes, and vaults to create single-shell and double-shell structures that are both strong and have beautiful shapes. At the same time, the heavy and dense form refers to the traditional adobe architecture of the Middle East. Using barbed wire as a resilient tensile element is an approach to tent culture. This effort results in creating a completely safe and strong structure. On the other hand, the construction of the shelter in this way, due to the use of very cheap materials, quick construction, and insulation, is one of the innovations used globally. This construction model is a kind of symbiosis between tradition and technology, and its sustainability is primarily because it can be established by the residents themselves with minimal training and does not need external resources.

Clay, which is the result of about 30 years of professional life, work, and experiences of Nader Khalili, an Iranian architect living in California, is a long bag with a width of 40-50 cm and the required length, which is filled with soil and like clothes tags with the help of two rows of barbed wire. In between, each of them is intertwined, and as they say, the building made of it is resistant to wind and rain, extreme heat and cold, fire and earthquake, etc.! The construction method is essential and even transforms construction from a specialized category to a category everyone can use. Clouds are not limited to a specific pattern. It has a pattern of 40-meter and 200-meter rooms. Abrasakht may be limited for building, for example, a large hall, but it is suitable for any number of rooms you want.

Constructing a House Using the Super Adobe Method

The structural foundation of the *"SuperAdobe-Abrasakht"* system is placed on sandbags with adjustable length. These large bags of reinforced soil were filled with special fibers that replaced the old straw and mixed with water to form long strands. On the one hand, access to this type of material without significant problems has provided facilities to spread the system. On the other hand, due to the flexibility of the form of the architectural design, the ability to maneuver in the field of shaping beautiful curves gives the structure of fabric; this all means the ability to use the mold and frame to shape, twist the forms and take advantage of the organic or organic design process while taking into account the necessary features for the structural direction, (Figure 9).

Figure 9: Sandbags of reinforced soil were filled with special fibers that replaced the old straw and mixed with water (Bani Massoud, 2008).

Instead of being made of separate blocks, the new domed buildings were formed by weaving these long strings of clouds of clay, and the sunlight and the heat of the clay environment dried them. In the process

of weaving such a building, it was possible to weave some of the main structures of the building into it; for example, different platforms or existing chambers could be woven into the heart of this building. Seismological tests showed that this type of building, which had a beautiful appearance and the ability to add different parts, uniquely withstand heavy earthquakes (Figure 10).

Figure 10: Long strings of clouds of clay have a unique ability to withstand heavy earthquakes (Bani Massoud, 2008).

Work implementation steps - cloud clay system

After choosing the plan, it is time to put it on the desired land for construction; after this step, the first row of super clay is placed on the plan. The bags usually intended for this purpose in a standard way are filled and tamped with wet soil during placement and placed on top of each other using the "running bond" construction method. In the meantime, two rows of barbed wire are placed between both layers of super clay after the bottom layer is hammered to restrain the tensile forces. This work aims to create a self-supporting structure resistant to tensile forces. A straightforward method of building a house from the walls, roof, and foundation, and in general, what it calls *"hard work,"* is fully applicable to this method (Figure 11).

Figure 11: Self-supporting structure resistant to tensile forces running bond" construction method (Bani Massoud, 2008).

After the Bam earthquake, Nader Khalili suggested that the officials build a house this way. Still, the officials did not see this method as suitable for various reasons, including the lack of a foundation and other defects. They are not classed in this research (Figure 12).

Figure 12: Before and after Bam City after the earthquake (Nadi, n.d.)

Clouds are very simple! Everything is provided almost on-site, and no expert is needed; the materials are soil, sandbags, and barbed wire. The bags, which are longer than regular bags, are filled with soil, although the barbed wires between these sandbag wick strips act as joints and neutralize tensile and lateral forces.

Features and application of clay shelter method with soil bag

A) Possibility of use in war-torn or earthquake-damaged areas

One of the applications of this method is the construction of shelters for war and earthquake victims. This method is different from a temporary shelter such as a tent or even a shanty and is considered a more permanent method.

B) Resistance to cold and heat

One of the positive features of this design, due to the use of clay walls and the unique shape of the building, is resistance to cold and heat and low energy consumption; A point that is the weakness of all other methods of temporary shelters.

C) Low technology and quick implementation

Using the most available materials, i.e., soil and low technology, is a positive feature of this plan. This feature is essential in remote areas or post-earthquake or war situations where the transportation and production of materials and electricity distribution in the affected areas are disrupted. It is used. With this method, with the help of the residents of each house, a suitable and resistant shelter can be implemented within a week at most (Figure 13).

Figure 13: Low technology and quick implementation (Saeed Sun, 2012)

D) Earthquake resistance

Due to the unique shape of these buildings and the way of transmitting power compressively, this building is earthquake resistant. This method has been approved in the United States as an anti-earthquake method, and a regulation has been developed for it. Since 1948, discussing habitation outside the Earth's atmosphere, especially the Moon and Mars, has been essential to Khalili's studies and research. In the same year, his plan to build a house on the moon with the super clay and giltafton system was presented to NASA, and since then he has been a member of the research team of the moon settlement and construction plan. In 1991, Professor Khalili founded the Cal-Earth Institute in the deserts of Hesperia, California. Cal-Earth is an educational and research institute where he and his colleagues continue their experiments on superclay and igneous samples. He taught from these houses how to be polite with them, (Figure 14).

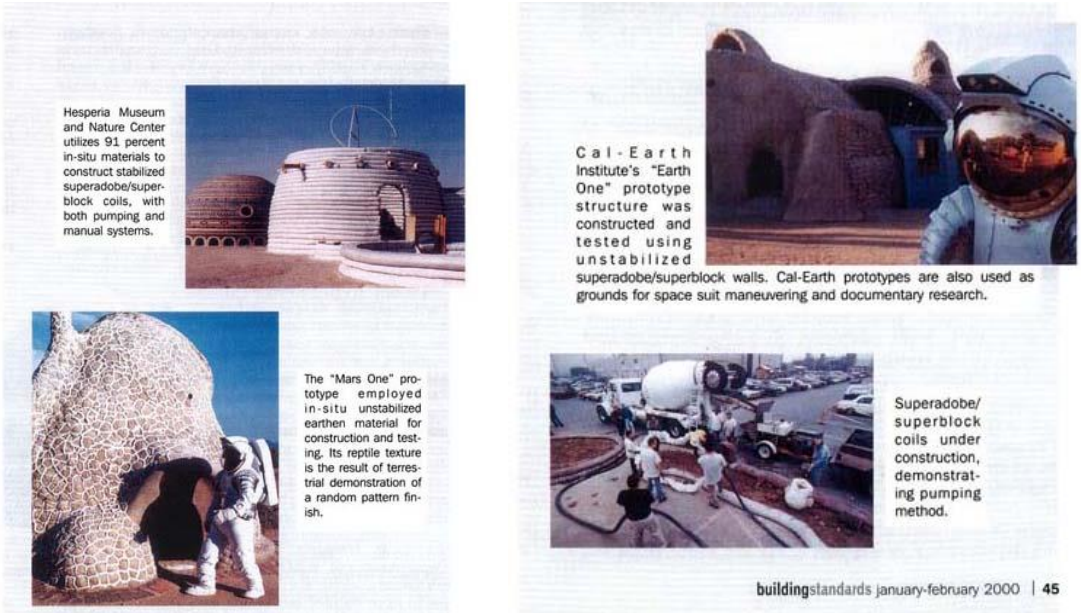

Figure 14: NASA's simulation for acclimating astronauts to these types of homes,

During the execution, wherever it is necessary to place a door or a window, the ability to use the mold in the superplay system comes to our aid easily by placing the mentioned molds (which will be removed later to install the doors and windows) the space The desired blank is formed).

As it was said, Abar Khesht is a structural system and building architecture, and the buildings built with this method are a shelter in case of emergency or a cheap shelter for people who cannot afford to build a house.

Therefore, building these houses in the shortest time with the least facilities and the most resistance against natural disasters is necessary. This technology has helped people in many parts of the world. Among the victims of Pakistan's earthquake in 2005 were the refugees of the Bani Najjar camp in Iran's Khuzestan province, the flood-affected people of Senegal, etc.

All these buildings are made of dirt. To build a mud house, you must first draw its plan on the ground, which includes one big circle and four small circles. Nader Khalili determined the dimensions and proportions of these circles. Approximately the area of each house is 40 square meters of interior space. The structure of this house is made of desert sandbags, which are implemented in the shape of a dome for its stability. During execution, the wall structure reaches the circle of the dome. After the walls and domes are completed, plastering is done on it. The purpose of this shelter is to show that after a natural disaster, there is a shelter that can be built within a few hours, and it is obvious that if there is a family of 4, the shelter should be made a little bigger and maybe the construction of this The shelter lasts a day. The construction of the most minor shelter, which is 2 x 2, only takes two hours. This shows the possibility of mass building, which works based on the sandbag construction technique, which Nader Khalili started more than 30 years ago. People from all over the world want to learn how to own a home for less. Educating these people has been a big part of Nader Khalili's goal. 50% of education is seeing and understanding. The type of construction is in harmony with nature. When a load descends, it is due to the pressure of gravity. And when the geometric shape of an arched arch is used, the load is transferred to the bottom. And it puts pressure on the arch and the load comes down and hits the ground very efficiently. Because the arch naturally conveys the load to the ground. All these buildings are made by people who have no expertise. And they want to build a house for themselves. This method is straightforward and inexpensive. *"Mr. Ian Lodge"* describes the method of building houses as follows:

"We do two things at Cal-Heritage. We build one house with soil, and for the second one we use the geometric shape of the dome. Because otherwise, it will not be fixed. We don't want to make these resistant to gravity, but we want to move forward in harmony with this force. Therefore, our consumables are only soil. It is not necessary to use iron or other industrial materials or wood. We use material that is available locally. If we have a project in Africa or Senegal, we take nothing there except our luggage and build a house with available materials. This construction method is low-cost and easy to learn. The biggest cost of this work is related to the work required. Because the materials are in the ground. And usually, there is no cost. If you know how to do this, you can do this with your family members. If a family member comes and learns this work and then returns to his country or place of residence, he can introduce the rest of the people and their families to this method, and they can also build a house for free and, for example, build a house for their relatives. And so it continues. These are creative solutions for a changing world."

They plaster the building to provide more protection against the elements and increase the beauty of the building. It is a soil plaster, 90% of which is ordinary soil, and 10% of the rest is cement (Hunter & Kiffmeyer, 2004). And cement prevents erosion during rain and maintains its integrity, and most of the California emergency shelter houses are 15 years old, since the school has been open there. This type of soil plaster is durable. Different methods are investigated in Kal Al-Arth and industrial materials are used as little as possible. Cal Earth's *"SuperAdobe*" buildings meet the strict earthquake codes of San Bernardino, California, USA. The building department was strict about ensuring Cal Erth's buildings conformed to these codes. Because it is Andreas' fault there. Nader Khalili went to that area because he wanted to be in a nasty climate, with cold in the winter and scorching heat in the summer. It is close to the earthquake zone, so if

there is a problem with the strength, it will solve that problem for other buildings in Southern California, which has stricter building codes (Kristral, 2009).

Nader Khalili helping to build a house with cloud clay *"Ian Lodge"* says about this:

"We improved so that everyone could go there. And request the building department of their place and say: We want to build a house for ourselves and problems such as the lack of supervision of the related department will not occur to them. We have no problem in terms of engineering and we can raise the work to another level."

Components of a "Super Adobe" house's walls

This house includes "superadobe" walls (thick walls). When you come inside the house from outside, you realize how cold the house is. The walls of this house act as insulation; they isolate a person from the outside air. All these structures are very comfortable from the inside, and the cost of their construction is also very low. In these buildings, ventilation devices are not used because there are no active systems. Bedrooms are small spaces added to the main space and built with earthen walls. About the bathroom of this house, some tiles have been added and used. There are also standard services such as plumbing, electricity, and water. It is easy to use the services of other houses in these houses. Living inside these houses gives peace to a person. These houses can be built entirely within 6 weeks (Figure 15).

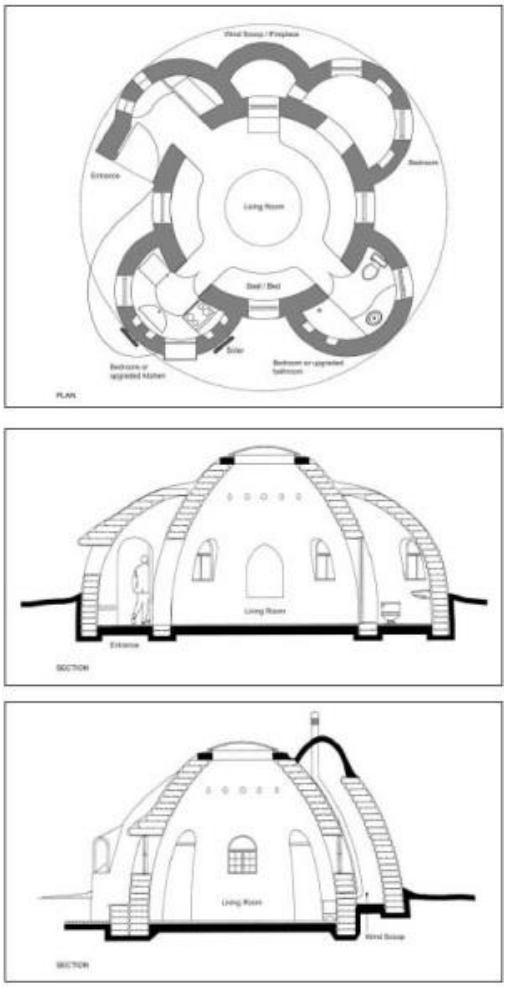

Figure 15: A simple plan of one of the houses built by cloud clay (Saeed Sun, 2012).

These houses include a tall chimney called Windghir. And it prevents strong wind in summer. Because there is a desert area and the temperature reaches 41 to 43 degrees Celsius. This wind deflector brings the wind from above into the building, And in a way, it creates ventilation. This is a passive method. This is one of the things used in the passive design strategy. Passive means that the active electrical system is not used in the building. The air transfer between the thick walls and this wind deflector makes the building feel good and comfortable. In winter, in typical houses, you heat the air to create heat, but once that air is out, you have no heat. In these houses, the walls and the walls absorb the heat and act like a battery and a power store. Instead of heating the air, you heat the walls and preserve the heat you use. But you need a heat source. And the sunlight must come into the house somehow, and this work is known as "direct interest." The sun directly heats the house floor, which is reflected inside the house. But you may not want the floor of your house to be heated in the summer. In the summer, the sun is high in the sky and shines directly, and its light does not enter the building through the window because you put a small light reflector on the window. And in winter, when the sun is at a lower altitude, the light shines directly through the window and warms the space.

The windows are installed in the building; in this way, we put some sandbags where we want the window to be and mold these bags into a hatch or window, then tear the sandbag and take out the material. It falls, and the window is made in this way. Or they put molds in place of the window and remove it after construction and place the window. So this is a great way to create a window using materials like sandbags and dirt, (Figure 16).

Figure 16: How to place windows in Adobe (Saeed Sun, 2012).

The platforms built inside the house and the entrance are also made of the same material. That is, by using a certain amount of cement; of course, in the case of these, 15% is cement, and the rest is desert sand. There is a type of facade construction in these houses, which is called *"Kashi rap"*. In the summer, this part of the wall is placed in front of the sun and the other part is in the shade so the building does not get too hot. During heavy rain, it disperses the rain and pushes it down gradually and controllably. And that's why the waters don't accumulate and come down in torrents. Some houses are not dome-shaped. A type of house called *"Setaghi"* is the first house in this shelter that is not circular. The floor of this house has straight lines, and no cement is used in any of the walls, only desert soil is made into bricks and plaster. The purpose of building this house is to show people and engineers a bio-compatible building with modern facilities and luxuries so that maybe it can eliminate the gap between bio-compatible houses and real life. Nader Khalili says: Many people have learned how to build these houses, and many others have witnessed the soil's transformation (Figure 17).

Figure 17: A house built by a cloud of clay (Saeed Sun, 2012).

Environmental and structural features of the house built by cloud of clay

- Providing functions needed by people such as living room, entrance hall, kitchen, bathroom, bedroom/living room, entrance hall, three bedrooms/living room, entrance hall, two bedrooms and bathroom

- The possibility of connecting two houses and forming a bigger house

- The possibility of building with a team of 3-5 people

- Use of natural ventilation and coordination with wind and sun

- Coordinated with the country's furniture standard

- Creating a sense of the desired interior space through the space between the two roofs

- Simple design based on tag unit repetition

- The possibility of expanding the space by adding a dome in the future

- Variety in the dimensions and shape of windows or elements such as sheds

- Repetition of tag and the sense of beauty of the building

- Windbreaker

- The presence of a dome and the creation of shadow and ventilation areas in summer and winter

- The game of light and shadow

- The use of standard frames and connections and the integrity of the building

- High resistance against atmospheric factors and fire

Case Study: Super Adobe in Disaster Relief

Earthquake Recovery in Haiti

After the devastating earthquake in Haiti in 2010, Khalili's superadobe technique proved instrumental in rebuilding homes quickly and efficiently. The superadobe system allowed for fast, cost-effective construction using locally available materials like Earth and sand. The dome-shaped superadobe design provides high seismic resistance, which is essential in earthquake-prone areas. Khalili integrated local labor into the construction process, empowering the affected communities (Figure 18).

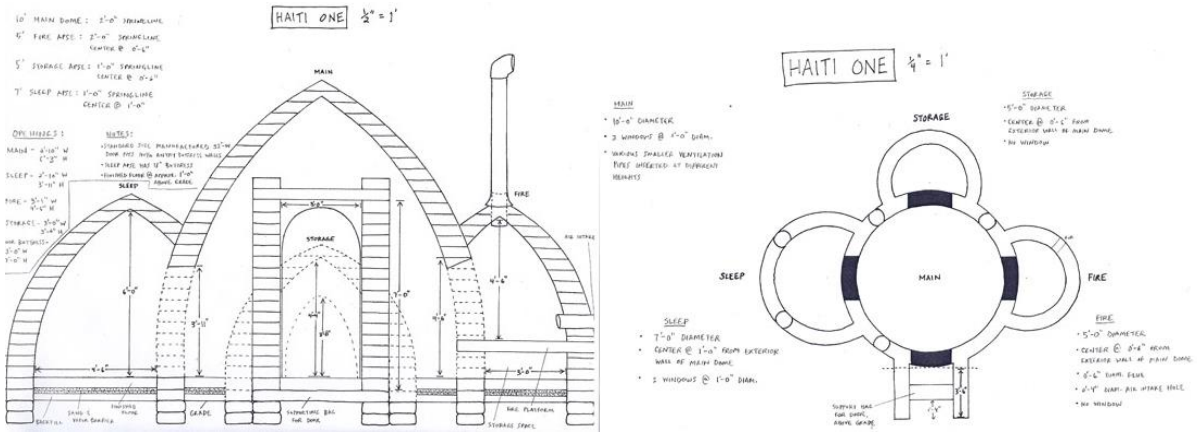

Figure 18: Sketch of the floor plan and Section of Haiti (Naidoo, 2010)

Local workers mechanically filled long strips with Earth to create these homes. The thick walls of these houses help maintain a lower interior temperature. The filling mixture comprised 90% earth and 10% cement, enhancing compressive strength (Anderson, 2012) (Figure 19).

Figure 19: A super adobe system is built using cement and soil, which is low-cost and fast (Naidoo, 2010).

In Masnavi, Rumi uses architectural metaphors to describe the reconstruction of the soul:

با این همه مهر و مهربانی دل می‌دهدت که خشم رانی
وین جمله شیشه خانه‌ها را درهم شکنی به لن ترانی
در زلزله است دار دنیا کز خانه تو رخت می‌کشانی
نالان تو صد هزار رنجور بی تو نزیند هین تو دانی

"With all this love and kindness, I would have loved to see you angry. You would have broken the glass of the houses and gone to sleep. The world is in an earthquake. You are washing clothes in your house. You are moaning. A hundred thousand sufferers will not live without you. You know" (Rumi, Divan Shams, Ghazals, Ghazal No. 2729)

This imagery reflects Khalili's philosophy: despite disasters that may destroy physical structures, it is possible to rebuild—physically and spiritually—using resilience and wisdom. The Superadobe structures embody this principle, transforming the Earth into a shelter resistant to future calamities.

Superadobe's Application in California

To promote earthen architecture as an alternative housing solution, an experimental village was established in Hesperia, California, based on Nader Khalili's designs. This initiative was supported by the non-profit organization *"Cal-Earth Institute"* (California Institute of Earth Art and Architecture) and the Institute for the Country, Art, and Architecture, located in Hesperia (Kristral, 2009). Khalili implemented his vision of sustainable architecture using superadobe technology at the Cal-Earth Institute in California. The Cal-Earth project explores how architecture can serve both humanity and the environment. These structures incorporate Rumi's spiritual principles, particularly the idea that Earth, fire, wind, and water are integral to the unity of existence. The buildings, shaped like domes and arches, mimic the natural forms found in desert architecture, blending with the landscape and relying on natural insulation to maintain temperature.

Khalili embraced Rumi’s philosophy:

در این خاک در این خاک در این مزرعه پاک بجز مهر به جز عشق دگر تخم نکاریم

"In this soil, in this soil, in this pure field

Let us sow no seeds except love, except love." (Rumi, Divan Shams, Ghazals,Ghazal No. 1475)

This poetic expression echoes Khalili's emphasis on using the natural environment—Earth, fire, wind, and water—as structural components, reducing reliance on external resources and creating a sustainable, spiritually infused architecture.

ZAV Architects' colorful dome on the Iranian island of Hormuz

Khalili's superadobe system was widely tested in disaster relief contexts, such as post-earthquake Haiti. The structures demonstrated high seismic resilience due to their dome-shaped design and the flexibility of the earthbag construction. Using local materials, including Earth and sand, made the process cost-effective and accessible to local communities (Kennedy & Wojciechowska, 2005, p. 175). Khalili's emphasis on training residents to construct these shelters further reflects his humanistic and sustainable approach. Due to their low center of gravity and thermal efficiency, these structures performed exceptionally well in resisting earthquakes and other extreme weather conditions. Integrating natural elements into the construction process ensured environmental sustainability and aligned with the spiritual principles Khalili cherished (Figure 20).

Figure 20: Bsabess Earthen Ecodome House in Benslimane, Morocco by E. Maroc (Bramer, 2023).

ZAV Architects' Dome

Iranian practice ZAV Architects drew on the colorful landscape of the island of Hormuz for this holiday community that is housed in around 200 brightly colored domes overlooking the Persian Gulf. Described by ZAV Architects as a *"cultural residence,"* the group of buildings is located around five miles from the main town on the Iranian island of Hormuz. The domed accommodation was designed to encourage tourists to visit the island while being an alternative to standard high-rise holiday apartments (Figure 21).

Figure 21: ZAV Architects designed the colorful holiday accommodation in Hormuz (Ravenscroft, 2020).

Presence in Hormuz intends to bring visitors to the forgotten island of Hormuz to increase the national and local GDP (gross domestic product) with the help of architecture," explained the studio. This project scales down a more significant development into many smaller spatial units, forming a field of colonies interlacing in a fluid fabric similar to a neighborhood (Figure 22).

Figure 22: ZAV Architects designed the colorful holiday accommodation in Hormuz (Ravenscroft, 2020).

Around 200 brightly colored domes contain holiday homes and facilities. The development contains 15-holiday homes that occupy multiple interconnected domes of varying sizes. These structures stand alongside other interconnected-domed buildings that contain restaurants, cafes, souvenir shops, tourist information, and reception areas. ZAV Architects arranged the domes closely to create a sense of community and give the development a distinctive outline drawn from the island's natural forms (Figure 23).

Figure 23: ZAV Architects designed the colorful holiday accommodation in Hormuz (Ravenscroft, 2020).

As the project is located in an open area a few kilometers away from the city, its spatial compartments and domes of different colors and sizes create a skyline topography that matches the colorful landscapes of the island. Interconnected domes contain holiday residences. All of the domes in development have been painted in bright shades of red, yellow, blue, and green to give the community a colorful exterior. This bold use of color continues inside the structures, where the interior walls are painted in matching shades, and furniture is colored red, yellow, blue, and green to match. Each dome was constructed using a low-tech method with a structure made of stacked sandbags filled with soil and sand dredged from the Hormuz dock. The sandbag forms were supported with steel and finished with cement. According to the studio, the construction method meant that people in the local community could primarily complete the buildings. There are upcoming community and learning center programs where people can improve their hospitality

skills. ZAV Architects hopes the project will contribute to increasing tourism and supporting the local community on the island (Figure 24).

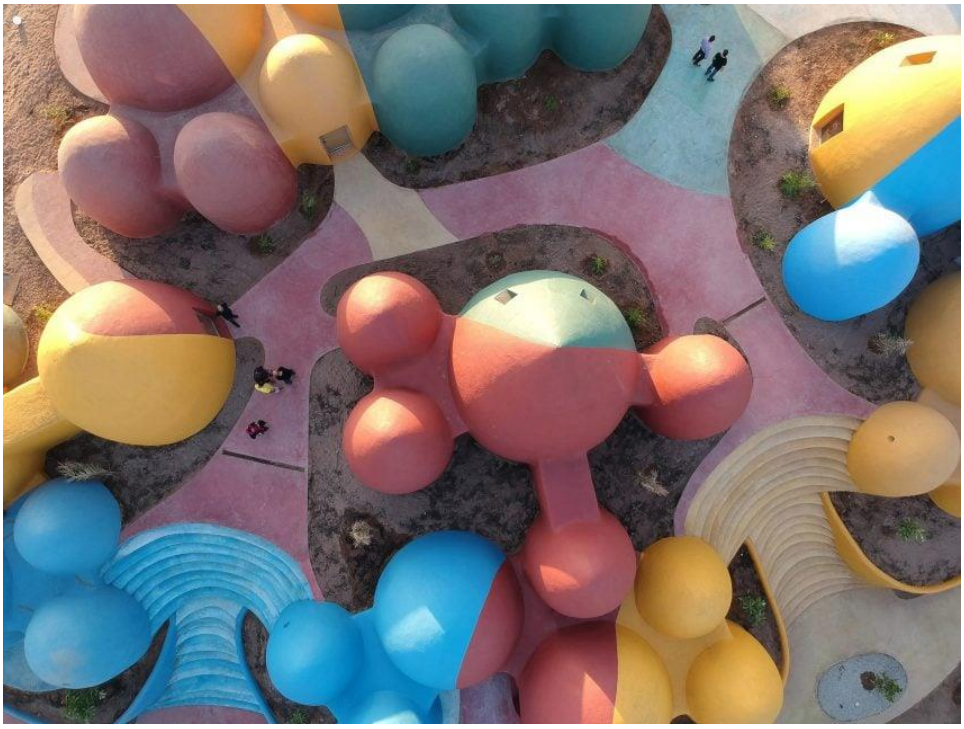

Figure 24: Interconnected domes contain holiday residences (Ravenscroft, 2020).

Architecture is a medium for creating and spreading a sensibility that reconsiders the conventional ways of seeing the status quo to move towards change and improvement.

Findings

Key findings from the study of Khalili's superadobe structures, inspired by Rumi's mysticism, include the following:

- Seismic Resilience and Sustainability: Khalili's superadobe structures offer a sustainable and resilient approach to architecture, with high resistance to earthquakes and other natural disasters. His designs create safer structures while promoting environmental harmony by utilizing local materials like Earth and sand in domes and arches.

- Humanistic and Mystical Integration: Khalili's work reflects Rumi's influence, blending architecture with spiritual values and transcending functional design. This approach elevates architecture as a medium of spiritual expression, acknowledging the unity of creation and enhancing human connection to natural elements.

- Cultural and Technological Relevance: Bridging traditional Iranian techniques with modern engineering, Khalili's superadobe method provides a culturally sensitive and cost-effective solution adaptable across different regions, particularly in areas requiring disaster recovery. His work demonstrates how architecture can harmonize cultural depth with innovative design.

Discussion

Integrating mysticism with sustainable architecture in Khalili's work presents a broader philosophical dialogue between spirituality and the built environment. His designs illustrate that when informed by spiritual traditions such as Rumi's, architecture can serve as a medium for expressing deeper truths about human existence. Khalili's superadobe system not only addresses environmental and humanitarian challenges but also embodies his belief in the unity of creation—a concept central to Rumi's teachings and Khalili's design philosophy.

Rumi's poetry offers a profound framework for understanding the architectural creative process, encouraging architects to embrace the spiritual dimensions of their work. This perspective broadens traditional architectural theory, inspiring functional and significant designs. Khalili's work exemplifies a model that honors local resources and cultural identities while offering practical humanitarian solutions, bridging the gap between tradition and modernity.

Conclusion

Nader Khalili's contributions to architecture extend beyond practical design, encompassing a realm of spiritual expression. His earthbag construction system, rooted in Rumi's mystical philosophy, provides an innovative approach to global housing issues while respecting human existence and the natural world. Khalili's work harmonizes traditional Persian architectural principles with sustainable practices, demonstrating the potential for architecture to connect the material and spiritual realms. His methods pave the way for future architectural designs that integrate sustainability with cultural and spiritual narratives, offering a powerful model for architects seeking to bridge these domains meaningfully.

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