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Brick Heritage, Economic Sustainability, and Tourism: Conservation of the Lahore Fort

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Abstract

For centuries, brick has been the primary choice for homebuilders. They show how society, economy and technology changed over the years. This paper considers the material conservation of a UNESCO World Heritage Site, the Lahore Fort, as a case study combining both heritage management and sustainable tourism. In this paper, the impacts of environmental and management variables, loss of masonry trend and tourism/heritage economy are reviewed through field visits, interviews with conservation experts, as well as documented physical evidence. The fort is also continuing to deteriorate because of the weather, humidity and improper repair work done previously.Their challenge detracts from the architectural integrity of the monument and decreases its desirability and financial prospects for cultural tourists. The strategy concentrates on the careful conservation of brickwork, in order that cultural heritage and economic development can be balanced. Craft and cookstoves designer with HERITAGE, should start promoting locally made wares, community-initiated tourism and the old brick bringing tradition in order not only to save age-old articles but also itsprofits both ways.

Keywords: Lahore Fort, Brick Heritage, Tourism, Conservation, Historic Management, Economic Sustainability.

1. Introduction

Bricks have been an essential component of building throughout history. They have formed the physical and cultural foundation of cities. They are strongly connected with the history of

architecture and the evolution of cultural identity throughout the ages. Historians typically consider walled towns as representatives of past social orders, economic supremacy, and methods of defence against their enemies. People have always liked bricks because they can be used for a variety of purposes, they do not break in the heat, and they are durable. This is true of the palaces built during the Mughal era and the temples of ancient Mesopotamia. The Romans widely used burnt bricks in constructing bridges, public buildings, and aqueducts. These buildings are still intact, which illustrates how sophisticated their economics and building methods were (Sofronie, 2021).

Brickwork is important for keeping both new and ancient structures in excellent shape.Sofronie (2004)says that brickwork makes up around 60% of the world's social infrastructure and over 90% of its cultural heritage buildings.Bricks are still a popular building material since they are inexpensive, healthy for the environment, and easy to locate.These attributes coincide with the present ideals of being responsible with money and the environment.

Even while brick is sturdy, it may progressively break down when it is subjected to chemicals, the weather, and stress from machines.The process of deterioration goes faster when there are soluble salts, living things proliferate, neglect, moisture gets in, and the temperature drops (Sofronie, 2021).As brick buildings age, they not only become less structurally sound but also lose their cultural value and potential to attract tourists. This indicates that conservation is not only a technical issue but also an economic-social imperative: Keeping the brick structures in good condition helps the regional economy through the attraction of tourists who come to see

historical sites, keeps cultural events going, and provides jobs to skilled and unskilled labour and those residing in the region.

1.2 The History of Brick Construction

Brickmaking was one of the first technological advances that revolutionised how people lived and worked. Commerce, social organisation, and urbanisation changed as Neolithic sun-dried bricks were replaced by precisely burnt brickwork (Butterworth, 1950; Sofronie, 2021). Sun-dried bricks were first created in Mesopotamia (now Iraq) in 8000 BCE. They were used to build homes, stores, and churches, which were important for creating rural communities (Butterworth, 1950).A significant technological advancement occurred about 5000 BCE with the introduction of kiln-fired brickwork. High temperatures cause clay to become denser and stronger, which reduces the likelihood that bricks will absorb water. According to certain archaeological studies, this method might have been discovered by chance when fire-exposed clay solidified and became more resilient than uncooked clay (Sofronie, 2021). This surprising discovery resulted in methodical brick-making techniques that revolutionised the construction industry for millennia. Throughout the Roman Empire, brickmaking became comparatively standardised and organised. Roman bricks were uniform in size and often bore the marks of military legions or imperial manufacturers. This gave the impression that many bricks were being built and that the administration was closely monitoring the situation. This standardisation demonstrates the empire's complex economy and preference for large, durable structures (Butterworth, 1950; Lynch, 2015).

Some places stopped building bricks after Rome fell, but Northern Europe started making them again.Brick is still a popular building material, both for utilitarian and ornamental purposes. This is illustrated by the Brick Gothic style of medieval Europe and its resurrection in the British Isles (Ahmad & Rehman, 2020).Before the British came, people in South Asia manufactured bricks the old-fashioned way.The Indus Valley Civilisation (2600–1900 BCE) was one of the earliest to adopt modular design in building things.They utilised bricks in a 4:2:1 ratio.This controlled ratio makes structures more sturdy and more appealing. It is being utilised in masonry today (Ahmad & Rehman, 2020).

By the time the Mughals came around, South Asian brick structures were exceedingly well-made and attractive.Using indigenous skills and design ideas from Persia and Central Asia, the Mughals erected exquisite forts, mosques, and gardens in towns like Delhi, Agra, and Lahore.The Mughal economy was strong enough to utilise baked bricks, detailed decorations, and elaborate embellishments.These items not only indicated how rich the culture was at the time, but they also revealed how rich it was (Khan, 2012).These structures illustrate how brick masonry has been employed in the past for both style and utility.

1.3 The Lahore Fort: A Look at Its Economic Role, Design, and History

Lahore, the capital of Punjab and the second biggest city in Pakistan, has traditionally been a hub for trade, culture, and politics.It was an important capital of the Mughal Empire since it was on vital trade routes in the past.Lahore was the hub of governance, art, and architecture during that period.The Lahore Fort, a prominent Mughal structure, is located in the Walled City.There are a

lot of historical landmarks in the city, and this is one of them.UNESCO declared it a World Heritage Site in 1981 because it is important to history and culture.It emphasised how important the building was and how it showed off the city's strong economy and culture (Department of Archaeology, Government of Punjab, 2023).

Emperor Akbar constructed the fort between 1556 and 1605. He desired it to be both attractive enough for events and strong enough to defend itself. The fort was enhanced in beauty and significance by Jahangir (1605-1627) and Shah Jahan (1628-1658), who added gorgeous gardens, expensive murals, and fine marble inlay (Kabir et al., 2024).The Alamgiri Gate, which lines up with the Badshahi Mosque, was erected by Emperor Aurangzeb (1658–1707).This created a visual line that still marks the historic skyline of Lahore (Khan, 2012).

The coordinates for Lahore are 31°25′ N and 74°12′ E.It is near the Ravi River and encompasses roughly 2,000 square km.The weather in the city is rather awful.In the summer, the temperature may reach 48°C, while in the winter, it can drop to -2°C.Most of the rain comes during the monsoon season, which lasts from June to September.There are more than nine million people residing in the metropolis, and most of them are Muslims.The Pakistan Bureau of Statistics (PBS) (2005) says that Punjabi is the major language spoken in that area.The environment and the people who reside there affect how well heritage structures are kept up.Changes in temperature, humidity, and pollution in cities can make old bricks and ornamental features break down faster (Ahmad & Rehman, 2020).

1.4 Chances for tourists, issues with preserving the past, and the history of architecture

The Lahore Fort is a blend of British, Sikh, and Mughal construction styles.This illustrates how long and interesting the city's past is.Emperor Akbar erected the first defences for the Mughal Empire.They were utilised for both protection and rituals.They built the website's structure.The fort looked better and had more complicated features when Jahangir and Shah Jahan worked on it(Kabir et al., 2024). Later, Maharaja Ranjit Singh and British colonial authorities altered a lot of the fort to make it better for military and administrative usage (Department of Archaeology, Government of Punjab, 2023). But even though the fort is incredibly enormous, it takes a lot of work to take care of it now.Brick structures are becoming worse due to air pollution, plants growing on them, water seeping into them, and a lack of maintenance. The fort may lose its authenticity, structural integrity, and ability to draw in cultural visitors if it is not maintained (Ahmad & Rehman, 2020; UNESCO, 2020). The location may still develop into a centre for eco-friendly travel, educational initiatives, and local economic development if the right preservation steps are implemented.

Lahore Fort should be preserved for two reasons: first, it protects a vital piece of the nation's past; second, it generates revenue from historical tourism. Businesses, including hotels, handicrafts, and guided tours, benefit from the region's thousands of tourists each year. Combining modern engineering and conservation methods with traditional Mughal brickmaking methods could improve the visitor experience and save long-term maintenance expenses (Murzyn-Kupisz, 2013; Qureshi, Naeem, & Iqbal, 2021; Sheikh, 2023).By using environmentally friendly methods to transform the fort's purpose, it might develop into a vibrant cultural centre. To encourage local activity, the building conducts workshops, cultural festivals,

and art exhibits.This would help people learn about various cultures and make Lahore a better location to learn about history and new ideas.UNESCO (2023) states that conserving heritage means more than merely keeping sites in good repair.It also helps people get employment, go to school, and feel proud of their common past.

In short, the Lahore Fort shows how culture, architecture, and economic progress can all function together.It is insufficient to save the past; it is equally essential to invest in the future to ensure that Lahore's legacy continues to inspire and assist subsequent generations (Ahmad & Rehman, 2020; Murzyn-Kupisz, 2013; Qureshi et al., 2021; UNESCO, 2020).

2. Review of Literature

One of the most durable and ancient building materials ever created is brick. This group includes them. They have significantly influenced the economics, technology, and architecture, among other facets of civilisation. They are a special fusion of art, science, and culture since they are created using materials, firing methods, and designs that demonstrate how individuals adjust to their environment and available resources (Hasan, 2021). This is because the materials used in their construction illustrate how humans can adapt to their surroundings. The evolution of brickwork from the rudimentary sun-dried bricks of ancient Mesopotamia to the ornate Mughal-era fired clay structures of Lahore is a perfect illustration of how architecture symbolises human resourcefulness, inventiveness, and significant social and economic progress (Sofronie, 2021; Khan, 2012). Bricks were used to build Lahore's structures during the Mughal era.

2.1 Brick Heritage and Economic Sustainability

Brickmaking has always been important to local economies and the cultural life of the local population, even though it is used in construction. The economics of entire communities have historically been significantly impacted by the production of bricks. This is because it gives both seasoned experts and people with less experience job chances. Clay mining, sculpting, drying, and fire have created self-sustaining economic cycles that benefit both urban and rural communities (Hasan, 2021). Bricks are made by shaping clay in a mould, drying it, and then heating it. Brick kilns that have been in operation for hundreds of years continue to play a significant role in the informal sector in countries such as Pakistan. The Government of Pakistan (2022) claims that itallows new cities to expand quickly and generate employment for thousands of people.

According to Throsby (2019) and Murzyn-Kupisz (2012), maintaining traditional materials and techniques strengthens the economy, especially by conserving tourist and cultural heritage. In addition to protecting historic sites, maintaining buildings like the Lahore Fort creates jobs and boosts local tourism-related income (UNESCO, 2020). We need to use effective preservation methods to maximise this economic potential. Over time, brick buildings that are subjected to environmental risks such as shifting groundwater, encroaching vegetation, pollution, and neglect often deteriorate. They all have an impact on the environment. These commodities may lose their cultural and economic worth as a result (Sofronie, 2021). It is critical to ensure the structural soundness of historic buildings to protect them and support the local economy.

2.2 Physical and Aesthetic Qualities of Good Bricks

The bricks' physical and aesthetic characteristics that are deemed to be crucial Bricks assist in maintaining a building's structural integrity in addition to enhancing its aesthetic

appeal and cultural significance. Bricks are characterised by their quality and attributes. Numerous factors can alter the colour, texture, and strength of burned bricks (Bender and Handle, 2022; Awan, 2023). These are components of numerous separate things. These criteria include the minerals in the clay, the degree of fineness in the clay preparation, and the efficiency of the fire process. For instance, clays with a high lime content produce lighter buff or cream tints. Conversely, clays with the most common deep red hues found in ancient structures are caused by significant iron oxide levels. In addition to enhancing the item's look, the range of colours represents local geology, customs, and skilled artistry and shows cultural identity (Butterworth, 1950). The sculpture's status as an artwork lends credence to this. A brick's porosity and water-absorbing ability are crucial factors since they affect how long it will last.Bricks of higher quality are less susceptible to frost, salt crystallisation, and efflorescence. According to Butterworth (1950), they typically don't absorb more than 10 to 15 per cent of their body weight in water in a given period of time. Overly porous bricks, however, decompose more quickly than less porous bricks due to their increased

propensity to allow water in and undergo temperature changes (Sofronie, 2021; Awan, 2023). This is because they are more easily permeable to water and air than ordinary bricks. Better bricks can increase a building's comfort by shielding it from fire, noise, and temperature fluctuations (Lynch, 2015). Historic structures that are intended to last for many generations benefit greatly from all of these characteristics. Because they require less maintenance over time, these materials are beneficial to the environment and the economy (Ahmad & Rehman, 2020; Azam et al., 2024). Using these materials is also environmentally friendly.

Figure 4.2: Salt Crystallisation and Efflorescence

2.3 Dimensional Stability and Heritage Integrity

When bricks are stressed by heat or mechanical forces, their ability to maintain their shape is known as dimensional stability. This is an essential part of preserving historic buildings. Because it maintains bricks in their correct shape, dimensional stability is essential. According to Bender

and Handle (2022), brick walls may fracture, fail at the joints, or move if they shrink, expand, or creep excessively. The aforementioned events have the potential to result in all of these outcomes. Brick misalignment and microcrack formation can result from prolonged exposure to high temperatures, high humidity, and minor seismic activity at significant locations such as the Lahore Fort. These adverse effects can be linked to the combination of these factors. As a result, the fort's structural integrity and historical authenticity are in jeopardy (Sofronie, 2021). There could be danger to both of these things.

As many various kinds of structures and methods of construction have evolved throughout human history, brick sizes have also altered. In order to blend strength and beauty, more elegant proportions became popular throughout the Mughal era (Hasan, 2021). Even though early Buddhist and Aryan temples were constructed using large modular bricks, this shift occurred. Mughal architecture is distinguished by its use of colour, symmetry, and proportion. It continues to be an important part of Lahore's history. When renovating something, it's important to make sure the new bricks will fit with the old ones. Internal stresses brought on by bricks of different sizes, shapes, or textures could accelerate the structure's collapse and lessen its visual appeal (UNESCO, 2020). Thus, preserving spatial harmony is both a practical necessity and a cultural duty.

2.4 Thermal and Acoustic Properties in a Sustainable Tourism Context

Not only do bricks keep structures together, but they also influence how we feel while we are inside them. Brick type has a significant impact on older cultural structures. Tiny-pored bricks tend to retain heat, making spaces feel cosy, but denser, heavier bricks allow heat to leave more

readily. Unexpectedly, moisture also has an impact. Butterworth discovered in 1950 that bricks could transfer up to 12% more heat when they were slightly damp. Controlling moisture is crucial for this reason. However, maintaining historic structures requires more than just keeping them dry or keeping them looking well; it also entails giving them genuine care and respect. The way bricks manage moisture and proper drainage may seem be little issues, but they have a big impact on how a room feels. Visitors to a heritage property are entering an atmosphere rather than only admiring the walls and windows. How well a location has been maintained often determines whether it feels cosy and inviting or chilly and remote. Ultimately, how we treat these structures determines how each person who enters them experiences them.

Good sound quality and consistent indoor temperatures are more pleasant and fulfilling. Longer visits result in higher tourism revenue (Lynch, 2015; Mason, 2002). Though they might not be as good at absorbing noise as other kinds of bricks, hollow or light bricks might be better at insulating. This is a consideration for galleries, museums, and performance venues housed in historic structures. The energy efficiency and sound quality of the building must be balanced in the restoration plans. By doing this, visitors will have a better experience, and the building's distinctive charm will be preserved.

A Comprehensive Economic Analysis of Weathering, Ageing, and Service Effects on the Economy. Brick can age without being seen as disrespectful, which is one of its many distinctive qualities. Bricks that have been left outside for a long period acquire a patina that improves their appearance and lends them a feeling of permanence and history (Hasan, 2021). Bricks that have been left outside develop a patina. Climate conditions that accelerate the degradation process can

have a variety of unintended consequences, including surface erosion, mortar disintegration, and the growth of moss or fungi(Sofronie, 2021). These adverse effects might be caused by environmental variables such as acid rain, air pollution, and fluctuating humidity. According to Butterworth (1950), efflorescence, which appears as the development of white crystalline deposits, frequently poses little risk to the structural integrity of a building. Even while it could lessen a building's visual appeal as well as its cultural and tourism worth, this is nonetheless the case.

Plants, especially those with roots or that are actively growing, can weaken the structural integrity of brick seams, as stated by the Department of Agriculture, Pakistan. It is crucial to respond quickly and do routine maintenance.

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Fig-2.1. Roof leakage of Khark Singh Havali

Fig-2.2. The dampness on back wall due to moisture in the retained material.

Repairing damage that has already been done is far more expensive than preventing harm. Because strong masonry requires fewer repairs, the government saves money and visitors continue to visit. Additionally, solid brickwork contributes to a consistent flow of revenue from visitors. The preservation of historical sites benefits culture and the economy, according to Throsby (2019). These advantages are enumerated in this sentence. As a result, traditional crafts are preserved, people feel proud of their common heritage, and community bonds are reinforced.

2.5 Linking Brick Quality with Tourism and Heritage Economy

The Lahore Fort, designated a World Heritage Site by the United Nations Educational, Scientific, and Cultural Organisation (UNESCO), is a prime illustration of the economic impact that can be achieved by the use of superior materials, fine craftsmanship, and cultural legacy. Khan (2012) asserts that robust brick masonry, characterised by regular dimensions, diverse colour schemes, and durable construction, exemplifies the mastery of technical skills and cultural sophistication by civilisation throughout history. The region attracts global travellers due to its historical and aesthetic authenticity. This leads to revenue-generating activities, including guided tours, cultural performances, and the sale of regional items (UNESCO, 2020). The integration of traditional bricklaying techniques in restoration projects enhances the relationship between environmentally sustainable development and the preservation of cultural heritage. According to Qureshi et al., (2021) and Ahmad and Rehman (2020), reviving artisanal brickmaking fosters job creation in rural areas, promotes local enterprises, and enhances regional identity. All outcomes are favourable. Local community participation in historical preservation is essential for promoting social peace and fostering inclusive economic advancement. Preserving brick-built structures like the Lahore Fort is an effective approach to promote eco-friendly tourism and enhance the cultural economy. The preservation of these structures benefits both the tourism sector and the cultural economy. Pakistan can maintain its brick culture by safeguarding its authenticity and encouraging community participation. Future generations will have the opportunity to generate income and take pride in their achievements.

3. Methodology

This study employed a case study technique to explore the factors contributing to brick deterioration, conservation challenges, and their implications for the Lahore Fort, a UNESCO World Heritage Site, as well as the impact on the economy and tourism sector. To attain a thorough comprehension of the administrative, environmental, and physical factors affecting the fort's construction, the study combines field observations with historical materials. Comprehensive on-site inspections were conducted to gather primary data, employing methods such as condition mapping, photographic documentation, and visual assessment to record deteriorating masonry sections. The findings elucidated the primary factors contributing to deterioration, which encompass biological growth, inadequate drainage, moisture intrusion, unsuitable materials, and the impact of human activity. Secondary evidence sourced from historical archives, restoration reports, and UNESCO documents elucidated previous conservation efforts and their outcomes. The identified patterns of deterioration were classified into three primary categories through a thematic analysis: anthropogenic harm, environmental exposure, and material ageing. The investigation examined the financial aspects of heritage conservation, including maintenance expenses, tourism revenue, and community involvement in preservation initiatives. This approach integrates technical assessment with socioeconomic analysis, establishing a comprehensive framework that identifies the primary causes of deterioration and emphasises the promise of conservation-oriented tourism as a sustainable strategy for heritage preservation in Pakistan.

4. Results and Discussion

Field examinations and historical research have uncovered that the brick masonry of the Lahore Fort is experiencing deterioration as a result of various environmental pressures, material incompatibility, and human activities. The incompatibility of the brick materials is the reason for this issue. Several significant issues identified include moisture intrusion, faulty drainage systems, improper application of contemporary restoration materials, and the excessive stress placed on the structure by visitors. The mortar joints have experienced degradation over time due to extended exposure to rain, moisture, or inadequate roof and surface drainage. The connection between bricks and mortar deteriorates over time due to efflorescence and salt crystallisation, both of which are caused by moisture. The phenomenon is particularly evident in regions characterised by shaded walls and at the base of structures, where evaporation rates are minimal. This phenomenon occurs as reduced evaporation fosters biological development and enhances moisture retention.

The surface showed significant scaling, powdering, and minor fissures, as demonstrated by images and videos captured during site inspections. The imperfections are particularly evident in proximity to the ground and water pathways. The process of biological colonisation, encompassing moss, algae, and lichen, can enhance the disintegration process by holding moisture and emitting organic acids that interact with the brick's surface. The ongoing operations have led to the erosion of the masonry fabric over time, resulting in diminished sturdiness and aesthetic appeal. Historical records indicate that numerous efforts have been undertaken to restore the structure, utilising cement-based mortars to enhance its stability. The durability of these mortars surpasses that of the lime-based materials traditionally employed in the original brickwork; however, their compatibility is lacking, leading to internal stress and cracking.

Cement mortar inhibits moisture evaporation, leading to the entrapment of salts and accelerating the degradation of materials. The variation in colour and texture of the repairs compared to the original surfaces leads to notable physical damage and aesthetic challenges.

Fig-4.1: Diagonal cracking caused by movement

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Fig-4.2: Vertical cracks at corners

The absence of regular upkeep and the failure in institutional duties have exacerbated the issue. Field data indicates that preventive maintenance seldom addresses issues such as water stagnation, excessive vegetation growth, and unrestricted guest access. Without a thorough conservation master plan, restoration initiatives tend to be short-lived and reactive, leading to ongoing cycles of damage and recovery. The limitations in technical capabilities within the Department of Archaeology (2023) coupled with inconsistent collaboration with engineering divisions and tourism agencies, have hindered the achievement of the long-term conservation objectives that have been set forth.

The climate of Lahore plays a significant role in exacerbating these material challenges. The masonry of the fort is subjected to persistent challenges posed by high humidity levels, rapid fluctuations in temperature, and significant pollution present in the urban environment. Contaminants interacting with brick minerals encompass nitrogen oxides, sulfur dioxide, and suspended particulate matter. Further examples encompass sulfur dioxide. The formation of

black crusts and sulfate compounds on the surface leads to changes in both texture and colour. Thermal expansion and contraction lead to microfracturing, while variations in moisture facilitate crystallisation and enhance biological activity. The structural integrity of the fort, along with its designation as a World Heritage Site, is at risk due to the prevailing environmental factors.

The condition of the masonry significantly influences the aesthetic appeal of the location, the satisfaction of visitors, and the potential income generated from tourism. Each year, countless individuals from Pakistan and around the globe travel to the Lahore Fort; however, the experience is significantly diminished due to the crumbling structures, restricted areas, and evident deterioration of the fort. The decline of the fort significantly impacts its status as an important cultural landmark and its ability to sustainably draw in visitors. Studies indicate that well-preserved heritage sites not only encourage visitors to spend more money but also inspire individuals to extend their stay and engage more deeply with the community. Effective conservation initiatives focus on two fundamental objectives: safeguarding cultural heritage and fostering economic development within the local tourism sector.

The findings of the study indicate that reverting to more conventional methods for environmental conservation represents a long-term strategy that is both effective and sustainable. The use of clay bricks, lime-based mortars, and indigenous restoration methods presents significant benefits for the preservation of the fort's original structure. Alongside facilitating natural air circulation, these materials enable minimal alterations to the structure, thereby decreasing the likelihood of additional damage transpiring. It is possible to create employment opportunities and assist individuals in recovering skills they may have lost throughout their lives by advocating for

traditional handicrafts and instructing local artisans in the restoration of historical buildings. This approach links the safeguarding of cultural heritage with the growth of social and economic prospects, transforming it into a joint effort where all individuals can engage. Alongside addressing technical challenges, it is essential to establish a permanent conservation and documentation facility at the Lahore Fort. To prevent issues, this unit must consistently oversee activities, maintain records, and carry out maintenance tasks. Enhancing the quality of your assessments and identifying structural issues more efficiently can be achieved through the integration of digital tools such as 3D scanning, environmental sensors, and geographic information systems (GIS) mapping. Minor challenges can be prevented from escalating into extensive repair endeavours by implementing a regular maintenance schedule, setting clear guidelines, and ensuring sufficient funding is available. Following UNESCO's historic management principles, a thorough strategy for preserving the Lahore Fort must incorporate local community involvement, public education initiatives, and the establishment of sustainable tourism practices. Establishing initiatives that inform both residents and tourists about the region can foster a sense of accountability for the safety of the area. Working together with governments, educational institutions, and international partners can enhance technical skills and ensure that conservation efforts align with global standards.

In conclusion, the deteriorating brickwork of the Lahore Fort poses challenges not just for the structure and its aesthetic, but also for the cultural and economic landscape of the surrounding area. Numerous factors play a role in the deterioration of the building, such as environmental pressures, mismatched materials, poor management practices, and limitations imposed by political and economic conditions. The fort's architecture can be enhanced and transformed into a

vibrant historic site through the application of a thorough conservation strategy that integrates scientific inquiry, traditional methodologies, institutional reforms, and active community involvement. The preservation of the Lahore Fort, alongside the promotion of sustainable tourism and local economic development, could ensure its status as a prominent emblem of Pakistan's cultural identity and a vital element of the nation's heritage economy.

5. Conclusions and Suggestions

Like many ancient towns, Lahore has two distinct identities: the present and the past. In addition to being the city's most well-known and significant structure, the Lahore Fort has deep cultural significance. Because of its significance to people worldwide, the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) listed it on the World Heritage List in 1981. Its great historical significance is the reason for this.There are a lot of things that are making the fort's current state of decay worse. Some of the reasons for this predicament are old materials, being outside, bad repair methods, not enough money, and not enough other ways to keep things in good shape. Research conducted in archives and field observations has established that the amalgamation of these factors poses a threat to the monument's structural integrity and its ability to support cultural tourism over an extended duration. The research findings indicate that neglect and insufficient care are the primary causes leading to the disintegration of bricks. Other things that can cause brickwork to break down are poor drainage systems that let moisture get into the brickwork, restoration methods that use materials that don't work well with the brickwork, and rising humidity that causes salt to crystallise inside the brick structure. Many more things can make brickwork worse. Water that sits on surfaces for a long period, especially at the bottom and

on walls that are shaded, speeds up the processes of efflorescence, mortar erosion, and surface scaling. This is especially true for the first one. This is why the structure doesn't look as good as it used to.

There are, however, simple and useful solutions around that could help with these problems. You can clean surfaces that have been discoloured or affected by salt without damaging the antique patina. To do this, you should use methods that are kind rather than aggressive. This group includes a number of different methods, such as using steam, controlled brushing, and diluted oxalic acid. To make the wall more permeable, it is better to use lime-based mortars instead of cement-rich ones. This is because lime-based mortars work well with the old brickwork. The stress level goes down, which stops moisture from building up in the wall. Some proactive steps that can lower the risk of degradation and the costs of maintenance that come with it are using preventative measures, including enhancing drainage, protecting the roof's structure, and controlling plants. Also in this group are the use of strategies that stop problems from happening.

To enhance the fort's state and establish it as a more appealing and sustainable cultural tourism destination, all stakeholders must address these technical and managerial challenges. Maintaining the integrity of structures can significantly benefit the local economy. This is accomplished by employing skilled artisans, tour guides, and community-oriented enterprises within the historical tourist sector. Murzyn-Kupisz (2013) and Throsby (2019) assert that these activities enhance individuals' cultural identification and stimulate interest in Pakistan's architectural history.

Given the fort's significance, it is essential to develop a comprehensive Heritage Conservation and Management Master Plan that addresses the fort's specific challenges. This plan should be executed as promptly as possible. To finalise this plan, it must encompass the following elements: Individuals are considering establishing an independent documentation centre to monitor materials, preserve the histories of restorations, and safeguard the photographic archives. This is undertaken to ensure the security of the archives. A permanent restoration team will soon consist of conservation architects, engineers, and traditional artisans. Enhancing research and training in brick conservation necessitates collaboration with the Departments of Archaeology and Tourism, along with institutions such as the National College of Arts (NCA), the University of Punjab (PU), and the University of Engineering and Technology.

Establishing regulations to allocate a specific percentage of tourist expenditures for activities that foster continuous maintenance, community engagement, and capacity development is essential. These duties will involve enhancing capacity, engaging community members, and ensuring operational efficiency.

The Lahore Fort is both an exquisite Mughal edifice and a significant centre for education and culture. It significantly benefits the economy, education, and culture. This edifice signifies far more than a mere stone memorial. The conservation of this heritage via tourism, traditional craftsmanship, and community engagement may aid in sustaining a vigorous local economy. Future research should focus on specific challenges, such as the impacts of traffic-related air pollution, soil subsidence, and tourism pressure, to offer evidence-based conservation solutions. With the implementation of a meticulously devised, scientifically validated, and community-

oriented strategy, the Lahore Fort might persist as an architectural marvel and a vibrant emblem of Pakistan's cultural continuity. Should the plan be implemented, this may occur.

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