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'Vastu Shastra'- An Important Aspect Of Culture And Heritage In The Design And Planning Of Sustainable Cities

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ABSTRACT

The UN Brundtland Commission first defined sustainability, in the year 1987, as "meeting the needs of the present without compromising the ability of future generations to meet their own needs", by endeavours and initiatives towards the preservation of a particular resource, natural or otherwise. In recent times, preservation of Cultural Heritage and in particular, Architectural Cultural Heritage has come into light as an important aspect of planning for cities of the future. 'Smart cities' in particular, foray into the technological and digital aspects of city infrastructure. The traditional Indian Knowledge System of 'Vastu-Shastra' has been ignored in this context, where western philosophies and theories in planning and design have become a popular norm. This paper will highlight the ancient wisdom of 'Vastu-Shastra' as Architectural Cultural Heritage of the Indian sub-continent and the need for its cognizance as an important aspect in the design and planning of sustainable cities. It will examine the four pillars of sustainability from the lens of the of 'Vastu-Shastra' and try to establish its contribution to the future of cities in the context of 'Sustainable Development Goals', citing through historical examples of city/town planning, and highlighting the various practices of sustainability embedded as culture and heritage. Thereby, one can see that 'Vastu-Shastra' is, by its application through historical times in planning and design in the Indian sub-continent as well as the South-east Asian region and therefore, by virtue of preservation of environment through diligent use of climate and regional response, has a strong connection to the historical and cultural aspect of the society. This makes it an integral part of the ACH of the Indian sub-continent and South-east Asian region and an important consideration for the future cities from the sustainability aspect as well as cultural heritage.

1. Introduction

1.1 The Concept Of Architectural Cultural Heritage

Cultural heritage is the legacy of tangible and intangible aspects of a community or society which are handed down from generation to generation. Cultural heritage is a connection between the traditions, faith and values expressed through certain practices from the past, in the present. Due to the attached values, ethics and faith for these groups or societies, cultural heritage which is preserved and maintained can bestow its benefit of future generations. The concept of cultural heritage can be considered as constantly evolving, due changing value systems, through time and generations. While, sometimes cultural heritage is symbolic and the connection to traditions creates a sense of community, its expression through architecture, traditional building practices, monuments or natural environments and use of indigenous materials offers various cultural narratives of a particular group or community or society. *(www.culturalheritagestudies.ceu.edu)*

The conservation of architectural heritage in urban spaces is not only about preserving the historical buildings of the past but also about uniting stakeholder groups, identifying architectural heritage, gaining a collective cultural identity, finding a sense of place and civic pride for residents, allowing everyone to appreciate the cultural values of the city today, and creating a cultural identity for future urban planning through this process (*Cauchi-Santoro, et al 2016*). In this light, it is also important to consider traditional concepts of planning and design for conservation as architectural heritage, which can be incorporated as is or with relevance to the changing values of the future.

A major underlying force in the evolution of heritage conservation is the shift in focus from the physical structure of heritage itself to the meaning that heritage conveys. The Convention for the Safeguarding of the Intangible Cultural Heritage in 2003 recognized that intangible and material cultural heritage is interdependent. Such heritage is also a crucible of cultural diversity and a guarantor of sustainable development. The Xi'an Declaration on the Conservation of the Setting of Heritage Structures, Sites and Areas in 2005 further extended the scope of the conservation and continuation of architectural heritage to relevant intangible heritage (*Gregory 2008; De Silva 2023*). With the development of the definition, focus, scale, and status of architectural heritage conservation, the emphasis is increasingly on the holistic value of architectural heritage, from a single building to a focus on the surrounding environment and urban development. (*Wen Liang, et al, 2023*)

1.2 Smart Cities and Architectural Cultural Heritage

New research suggests that smart cities should capitalize on local strengths and give prominence to local culture and traditions. A new generation of smart city is emerging, in which cultural heritage and sustainable urban development go hand in hand with social and cultural values and live-ability (*M. Angelido, et al, 2020)*

Architectural cultural heritage is important in the development and sustainability of smart cities. It creates a symbol of identity and pride for the community. Integrating these elements into smart city development helps maintain a sense of place and connection to the past, fostering a stronger sense of belonging among residents. It can become a source of economic benefits through tourism. By preserving and showcasing architectural cultural heritage within smart cities, governments can promote tourism and create opportunities for local businesses, thus driving economic growth. It also, serves as a platform for social cohesion and community engagement where communities come together for events, celebrations, and other activities. By incorporating sustainable practices, smart cities can promote environmental sustainability while maintaining their historical significance. Integrating architectural cultural heritage into smart city development can

inspire innovation and creativity in urban planning and design. Cities can demonstrate a forward-thinking approach to preserving their heritage while embracing the future.

Overall, architectural cultural heritage enriches the fabric of smart cities, contributing to their social, economic, environmental, and cultural vitality. Integrating these elements into urban planning and development ensures that smart cities remain vibrant, inclusive, and sustainable for future generations.

1.3 Sustainability In Cities Of The Future

Climate change and environmental degradation along with preservation of cultural heritage are among the biggest challenges of our times. It is important to note that culture and cultural heritage can help to achieve inclusive and sustainable development. The Brundtland Report ("Our Common Future") clarified the goals of sustainable development and introduced the three pillars or principles of environmental, social and economic sustainability, also known as ESG (Environmental, Social and Governance). Environmental sustainability is the ability to preserve and protect the natural environment over time through appropriate practices and policies, meeting present needs without compromising the availability of resources in the future.

Social sustainability involves a focus on the well-being of people and communities. Economic sustainability is the approach whereby economic activities are conducted in such a way as to preserve and promote long-term economic well-being. In practice, it aims to create a balance between economic growth, resource efficiency, social equity and financial stability.

2. Methodology

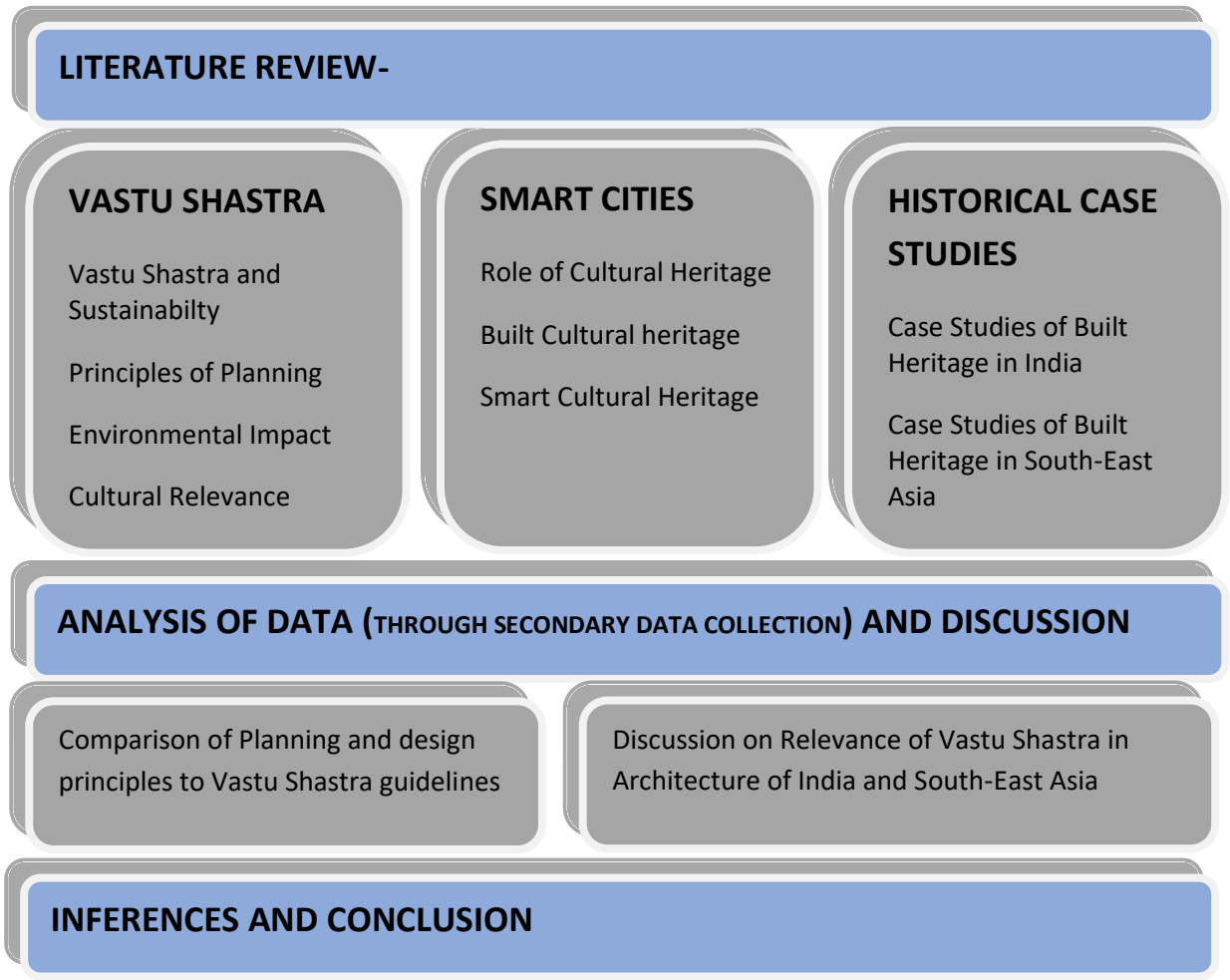

Fig.1. Methodology chart

In order to establish Vastu-Shastra as an Architectural Cultural Heritage (ACH), which is important for future sustainable and smart cities, this paper, firstly, endeavours to study its relation to sustainable principles of architecture and building and its intended influence on the environment and society. The research, also delves on its historical and cultural influence in India and South-east Asia, through literature review. Next, a few relevant case studies of planning and design of architecture in India and South-east Asia are provided to elaborate and strengthen the contention of its influence as a heritage, to be preserved in the building of new future cities. Through further comparative analysis of planning principles and the sustainable aspects of architectural culture heritage, the research concludes with the inferences drawn from the discussion of the same.

3. Vastu Shastra

3.1 Vastu Shastra and the Sustainability Factor

Vastu-Shastra is an ancient architectural planning and design system originating in the Indian sub-continent, with influence in South-east Asian regions, and it is deeply ingrained in the cultural heritage of its area of practice. It is included as an important branch of the traditional Indian Knowledge Systems (IKS) of India. The Ancient texts like *Mayamata, Manasara,* as well as later texts like *Samarangan Sutradhara, Vishvakarmaprakasa* enumerate the principles and recommendation for planning and design which take advantage of the five basic elements of nature known as '*Panch-maha-bhutas*' (earth, water, fire, air and space), the magnetic field of the earth and the influence of the sun, moon and other planets surrounding the earth with an intention to bring balance and harmony between man, nature and the place of residence. These principles were formulated keeping in view the cosmic influence of the sun, its light and heat, solar energy, the direction of wind, the position of moon, the earth's magnetic field and the influence of the cosmos on our planet. Vastu-Shastra influences any type of building and its inhabitants on the face of the earth and therefore, has a universal application.

The basic principles (*Patra,R., 2014*) that are followed in Vastu-Shastra are:

i. The doctrine of orientation (*Diknirnaya*)- The orientation of buildings involves setting them in such a way that they may get maximum benefits from solar radiation. The fixing of cardinal points thus occupies a prominent place in *Vaastu-Shastra.(Chakrabarti,V.,1998: 101–102)*

ii. Site planning (*Vaastu–Pada–Vinyasa* or *Vaastu–Purusha–Mandala*) (Fig. 1.)- It recommends the examination of the soil, size, shape, taste, colour, and smell and vegetation features of the land. After the land is found suitable for building in these aspects then it is evaluated for the purpose of building a house, village, industry, town, fort etc. After this, *Vaastu-Purusha-Mandala* is provides the grid that facilitates zoning design as per the usage or activities. *(Patra, R 2007)*

iii. The proportionate measurement of building (*Mana*, *Hastalakshana*)- The measurements are divided into six categories – measurement of height, breadth, width or circumference, measurement along plumb lines, measurement of thickness and measurement of inter-space. The role of *Vastu-Shastra* in the system of measurement is to achieve harmony between the absolute and the quantifiable. *(Chakrabarti, V., 1998, pg.35)*

iv. The six canons of Vedic architecture (*Ayadi*, *Sadvarga*) *(Shukla, D.N., 1993, pgs. 211–217)*

a) Aayaadi-Sadvarga *(Aadistaana)*
b) Column *(Paada or Stambha)*
c) Entablature *(Prastaara)*
d) Wings *(Karna)*
e) Roof *(Shikara)*
f) Dome *(Stupi)*

v. Aesthetics of the building or the character of the building, its aspect and prospect etc.(*Patakadi*, *Sadschandas*).- Traditional principles contour buildings in multifarious forms, structures varied from one another to suit the different classes of buildings, to satisfy different functions, and they never present an identical view. As a result, *Vastu-Shastra* has been described as a body of knowledge, which has been sustained, developed and modified by successive generations of architects through many centuries. It implies a tradition of knowledge that has, at various times, been ordered and expressed (and so is handed down to us) in a range of texts, with a variety of titles.*(Patra, R., 2014)*

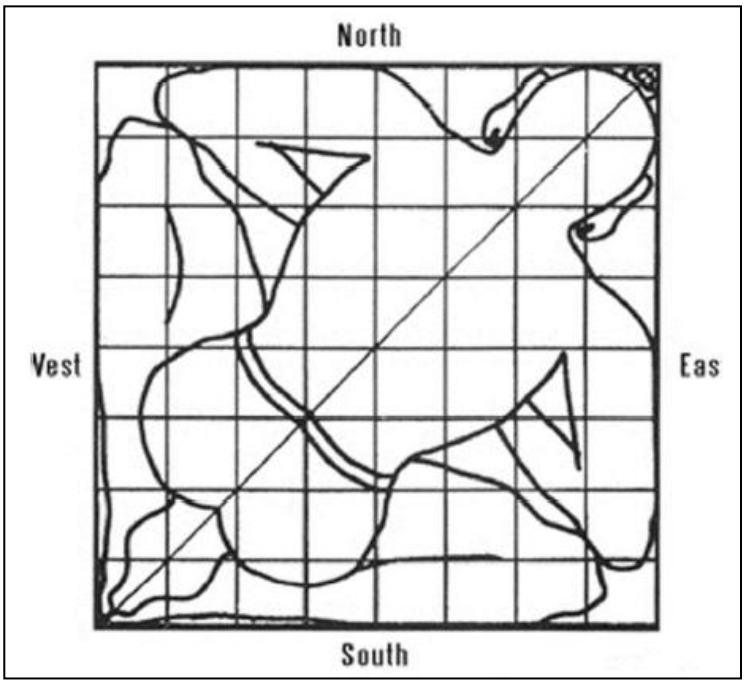

Fig. 2. Vastu-Purusha-Mandala (Chakrabarti,V., 1998, pg. 85)

These principles take into account the context of the site with respect to climate, the locally available building materials, their quality and size and structural strengths and limitations, locally prevalent skills and art forms, cultural influences and habits and traditions, contextual natural resources, etc, while focusing on leaving the least carbon footprint and preserving the environment. Careful study of these principles points to their positive influence on sustainability and at the same time ensuring good health, peace, prosperity and happiness in society.

3.2 Vastu Shastra as Cultural Heritage of India

3.2.1 Historical roots- Vastu Shastra has its roots in ancient Indian texts such as the Vedas and the Puranas. Its principles have been documented in texts like the *Vishwakarmaprakasha*, which dates back thousands of years. This long history ties Vastu Shastra to India's ancient cultural heritage.

3.2.2 Spiritual and philosophical connection- Vastu-Shastra is not merely a set of architectural guidelines but is also intertwined with spiritual and philosophical beliefs. It is based on the idea of harmony between humans, nature, and the cosmos. Elements such as directions, energy

flow, and the balance of natural forces are considered crucial for creating harmonious living spaces, reflecting broader Indian philosophical traditions.

3.2.3 Architectural influence- Throughout India's history, Vastu-Shastra has significantly influenced the architecture and urban planning of various structures, including temples, palaces, homes, and even entire cities. Many iconic historical monuments and buildings in India have been constructed following Vastu principles, showcasing its impact on the country's architectural heritage.

3.2.4 Cultural practices-Vastu Shastra has also influenced various cultural practices and rituals in India. For example, the orientation of homes and temples, the layout of cities, and the positioning of furniture within homes are often guided by Vastu principles. These practices reflect the cultural significance of Vastu Shastra in shaping daily life and societal norms.

3.2.5 Continued relevance- Despite modernization and urbanization, Vastu-Shastra continues to hold significance in contemporary Indian society. Many individuals and communities still consult Vastu-Shastra when constructing or renovating buildings, demonstrating its enduring presence in India's cultural landscape.

Vastu-Shastra is, therefore, deeply embedded in India's cultural heritage, reflecting centuries-old traditions, spiritual beliefs, and architectural practices. Its continued influence underscores its significance as a cultural legacy that has shaped the built environment and cultural practices across the Indian subcontinent.

3.3 Vastu Shastra as Cultural Heritage of South-east Asia

Vastu-Shastra, while originating in India, has also had an influence on the cultural heritage of some countries in South-east Asia, primarily due to cultural exchange, migration, and shared historical connections.

3.3.1 Historical trade and cultural exchange- Over centuries, there have been significant trade and cultural exchange between India and various countries in South-east Asia, such as Indonesia, Malaysia, Thailand, Cambodia, and Vietnam. This exchange facilitated the spread of ideas, including architectural principles like Vastu-Shastra.

3.3.2 Indianized kingdoms- Several kingdoms in South East Asia, such as the Khmer Empire (present-day Cambodia), the Srivijaya Empire (present-day Indonesia), and the Chola Dynasty's influence in South-east Asia, were influenced by Indian culture, religion, and architecture. Temples and other architectural structures built during these periods often exhibit elements influenced by Vastu-Shastra.

3.3.3 Temple architecture- Many temples across South-east Asia, particularly those dedicated to Hindu deities, feature architectural elements that bear resemblance to Vastu-Shastra principles. These include features such as directional orientation, spatial arrangement, and symbolic representations, which reflect the influence of Indian architectural traditions.

3.3.4 City planning- Some ancient cities in South East Asia may have been planned according to principles similar to those found in Vastu Shastra. While not explicitly labelled as such, the layout of cities and urban spaces in regions influenced by Indian culture may reflect ideas of cosmic harmony and spatial organization found in Vastu Shastra.

3.3.5 Continued influence- Even in contemporary South-east Asian societies, traces of Vastu-Shastra's influence can be observed in architectural practices, urban planning, and cultural traditions. While not as prevalent as in India, Vastu Shastra continues to hold significance for some communities in the region, particularly those with historical ties to India.

While, Vastu Shastra may not be as deeply ingrained in the cultural heritage of South-east Asia as it is in India, its influence can still be detected in various aspects of the region's architectural and cultural landscapes, highlighting the interconnectedness of cultures across geographical boundaries.

4. Smart Cities and Cultural Heritage

There is no single definition of a 'Smart City that is universally accepted. It may mean different things to different people depending on the level of development, the willingness to change, implement and reform, the resources and the expectations of the local communities.*(Siountri, K., 2018)* In the recent past, many cities have decided to implement the Smart City concept as a development strategy for growth. In many cases, such planning strategies are for bridging technological-based solutions with urban development. Studies suggest that the socio-cultural aspect is increasingly being considered an important aspect in the Smart City concept. Preserving the historical and architectural heritage is a crucial aspect in maintaining the connections between the past and future of communities within the Smart City. Smart City solutions are expected to use ICT (Information and Communication Technologies) to deliver high-quality services and achieve operational cost savings and bring about a change in the behaviour and lifestyle patterns of the users and the community. Smart Cities are designed to create a more inclusive, sustainable and connected environment. (*http://heritage.intach.org/)* In this scenario, attempts can be made to incorporate and preserve the Architectural Cultural Heritage of a Smart City through smart cultural solutions. Smart Heritage approach will be to establish cultural heritage conservation and promotion as a unique component among smart city plans.

5. Case Studies

The case studies chosen and examined below have been selected on the basis of their historic relevance, cultural influences of their location and their popularity among general population for religious reasons as well as places of tourist significance.

5.1 The city of Jaipur, India

The walled city of Jaipur (Fig. 2.) was founded in 1927 by Maharaja Sawai Jai Singh, and was designed by Vidhya Dhar Bhattacharya. It reciprocates the natural geographic boundaries since the eastern and western edges are marked by the Aravalli range. *(Pusalkar. S., 2022).*The city of Jaipur is built in the form of an eight-part *'Mandala'* known as the *'Pithapada'*. It is designed in accordance with the *Vastu-Purusha-Mandala*, which is a perfect square with sub-divisions of 3X3 checker-board patterned smaller squares (nine-grid plan). The master plan of the city depicts a divisional layout in the Chowkris. The city was divided into nine blocks, of which two consist of the state buildings and palaces, with the remaining seven allotted to the public. The number 9 signifies the planets *(Nav-graha)* of the ancient astrological zodiac. The commercial shops in the city were also designed in the multiples of nine, having one cross street for a planet. The central pivotal grid is delineated to the palace, as a Brahmasthana. The subdivisions of the third, fourth, fifth, sixth, seventh and eighth squares reciprocate to *Apa, Aryama, Swtra, Vaishnav, Indra* and *Mitra* after being superimposed on the *Vastu-Purusha-Mandala*. The 9th subdivision that is situated along the south-eastern cardinal direction is the position of Rudra. These 9 chowkris are defined by the grid iron pattern, and the minor chowkris are further sub-divided into 7x7, 8X8, and 9X9 checkered-board grids by the streets of Bazaars (markets) and Rastas (roads). The micro division of plot size is based on family size and economic status. Huge fortification walls were made along with seven strong gates for the security of the city. *(Pusalkar. S., 2022)*

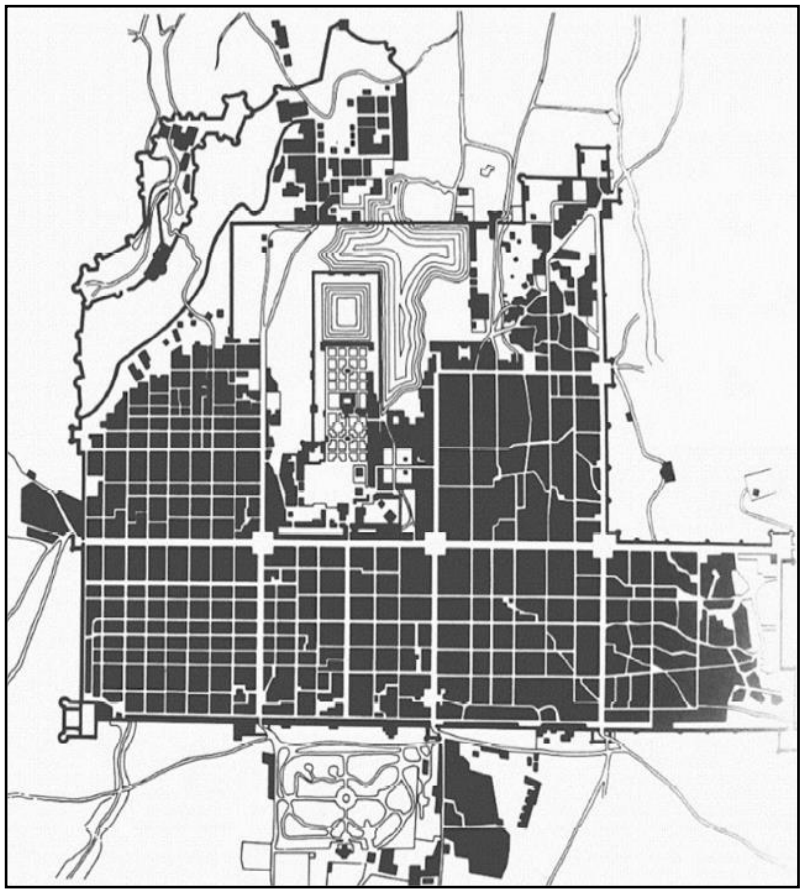

Fig. 3. Map of walled city of Jaipur (Doshi & Chauhan, 1989, pg. 9)

The cardinal directions and their astrological significance are of prime importance in the design of the layout of the city. The *Vastu-Purusha-Mandala* derives energies from the cardinal directions. Since the eastern and western boundaries of the city are marked by the Aravalli range, the East-West axis forms the ridge line in the city planning.(Fig. 3.) The northern edge is secured by the forts of Amber and Jaigarh. The cardinal direction of North was also strengthened by Ram Harihar Temple and Kal Bhairav Temple. The Southern edge is guarded by the temple of Lord Shiva, since the Shankar Garh is located along the southern cardinal direction. The eastern edge is marked by the rising Sun, and hence, the Sun temple and sacred Galta Ji temple are located in the east of the city. The Eastern cardinal point is guarded by Suraj Pol (since it is the direction in which the Sun rises). The western cardinal point is guarded by the Chand Pol (since it is the direction in which the Sun sets and the moon rises). These Pols are influenced by the rise of the Sun in the daytime and the rise of the Moon at night. The third gate is the Northern gate or the Zorawar Singh gate, which faces toward the ancestral capital of Amber. The core of the city or the Brahamasthan houses the Govind Dev Ji Temple. It is in this manner that the temples serve as the religious guards to the city. The forts or the political powers are held in place by a centrally located palace. Most activity generations in spatial planning are results of synchronized relations in the planetary positions of the Sun, Moon, and Earth. *(Pusalkar. S., 2022)*

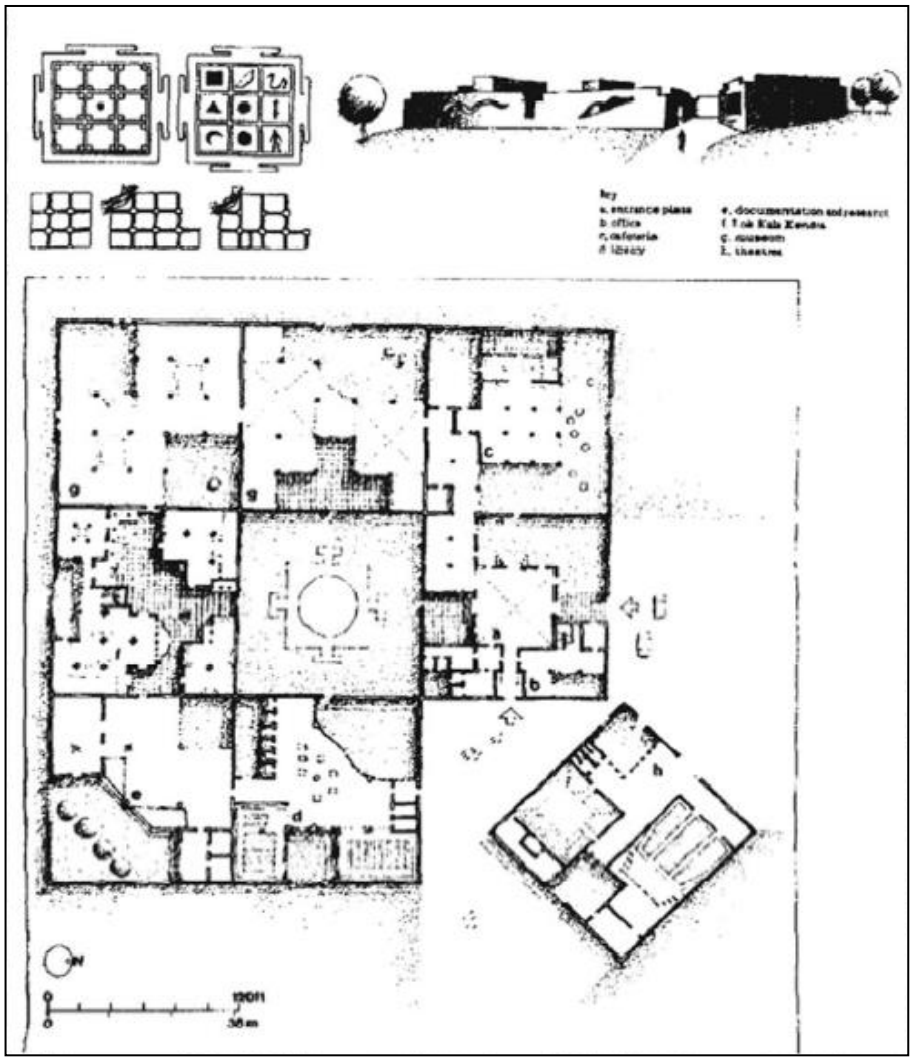

Fig. 4. Interpreting Mandala plan for Jaipur (Chakrabarti, V., 1989, pg. 127)

The walled city of Jaipur is harmoniously connected by a network of roads. The six primary bazaar streets are aligned in the East-West and North-South directions and intersect at major junctions in the city, Amber Chowk, Manek Chowk, and Ramganga Chowk. These bazaar streets function as important trade routes and divide the city into the nine blocks or chowkris. The rectilinear grid iron pattern for the design of primary and secondary streets is followed in the layout of most of the blocks or chowkris, and is under the astrological influences of *Nav-graha*. The streets along the North-South axis receive harsh, direct sunlight from the Southern hemisphere for only a short duration of the year, and those oriented East-West rarely get any harsh, direct sunlight, making them comfortable. The orientation of the primary streets in accordance with the position of the Sun depicts a bioclimatic street design layout. The secondary streets are narrower and oriented in a manner to block the harsh sunlight. The directions of each street and market are east to West and North to South. *(Pusalkar. S, 2022)*

5.2 The city of Chandigarh, India

The capital city of Chandigarh was built by the French architect, Le Corbusier, in 1950. Although Le Corbusier followed his own architectural philosophy of the Five Points Architecture, the master layout of the city corresponds to the *Vastu-Purusha-Mandala*. The city is designed on the principles of Vastu Shastra, and adheres to the correct placement of various activities in the right

direction, under the influence of respective planets, which tends to bring happiness, prosperity, and peace of mind.(Fig. 4.)

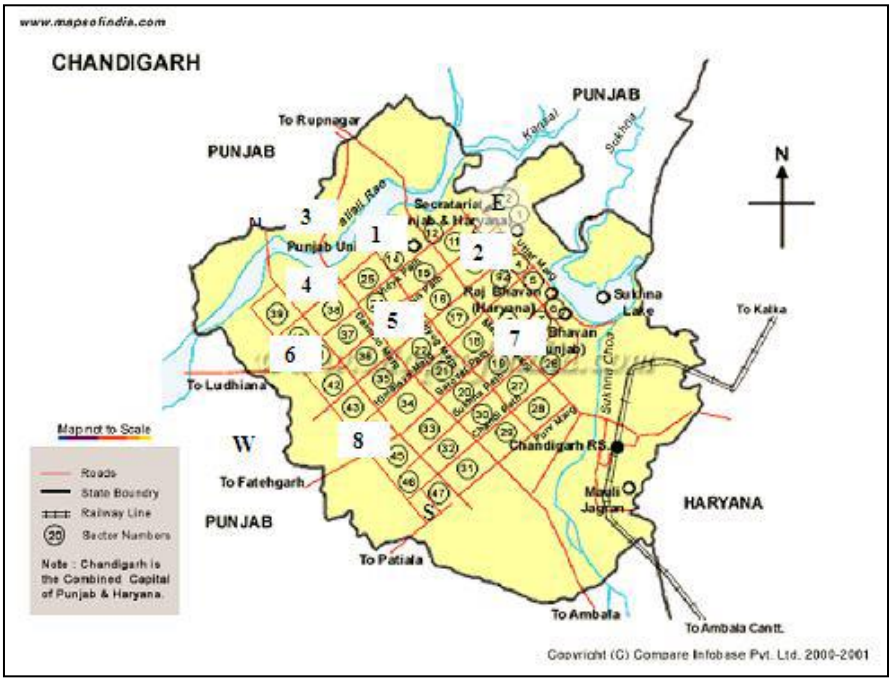

Fig. 5. Map of the city of Chandigargh (Patra, R, 2014)

According to Vastu-Shastra, Lord Brahma occupies the center of any place *(Brahmasthan)*. As a result, Sector 17, which serves as the City Centre, is situated at the heart of the city. It is the administrative district of the city, and serves as a place for assembly. It also houses a temple of Lord Brahma. The Capital Complex in the city, which symbolizes the head, is situated in the north-east direction, which coincides with the head of the *Vastu-Purusha-Mandala*. Furthermore, the north-west corner of a place is termed as the darker side of the area. Hence, a crematorium is in that cardinal direction. The industrial area is located in the southern areas, which also matches Vastu Shastra principles. Additionally, the areas situated in the west and south directions are considered favourable for living (sleeping, eating, etc.), and hence, residential buildings are located in the South-west, South, and West zones of the city.

As per the principles of *Vastu-Shastra*, the place for water should be in the North or East direction. In the city of Chandigarh, too, the Sukhna Lake occupies the East or North-East corner, which is considered a sacred place for water and meditation since the morning rays of the Sun are considered rich in ultraviolet rays and kill germs and disease-causing bacteria in the water. Furthermore, according to the principles of Vastu-Shastra, the place for worship or studying should be placed in the North direction since that is the direction in which the planet of Mercury *(Budha)*, which is attributed as a treasure of health and knowledge, rules. As a result, the PGI (Hospital) and the Punjab University are located in the North direction of the city.

5.3 Jawahar Kala Kendra, Jaipur, India

The Jawahar Kala Kendra Arts Centre in Jaipur, India was designed in 1986 by Ar. Charles Correa to promote traditional and local arts and crafts. The structure is contemporarily designed with the themes of science and the cosmos, depicting the planets of the universe guiding life and well-being in the planning. The structure occupies 9.5 acres, and its design is symbolically inspired by the design of the traditional city of Jaipur, which was based around the nine interconnected squares of

the *Vastu-Purusha-Mandala*. The underlying construct of the *Nava-graha* or the nine planetary energy fields is invoked in the spatial design of the Jawahar Kala Kendra.

The design of the Jawahar Kala Kendra is also a pure square, which is divided into nine micro 3X3 squares, depicting the energy fields of the *Nav-graha*. Each of the squares is of the size 30mx30m, and is bounded by walls that are 8m high. The program of the structure adheres to the eight separate planetary positions, which correspond to the energies represented by the specific planet. The square at the center is the unit of coherence to the structure and is left vacant, serving as the interactive courtyard that is open to the sky. The central square represents the 'void' of Vastu-Shastra, which stands for - Nothing which is everything. The courtyard has the diagram of a lotus as its flooring pattern, which serves as the seat of *Brahma* in Vastu Shastra.(Fig. 5.)

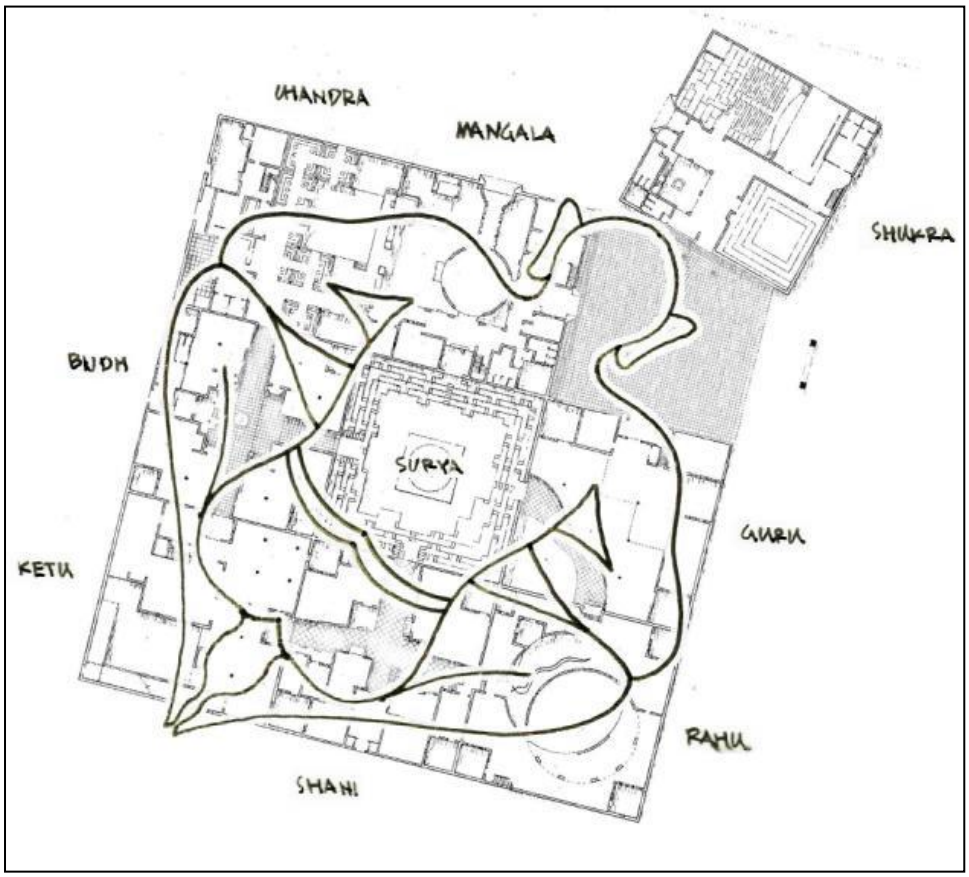

Fig.6. Plan of Jawahar Kala Kendra with Vastu-Purusha-Mandala (Singh, A, et al, 2020)

The layout of the structure is aligned to the cardinal directions as well, with only the exception of the (*Shukra)* block, which is slightly different from the other blocks. The spaces are positioned in accordance with the required astrological supremacy. The administration block *(Mangal)* is aligned to the north-east diagonal of the Vastu-Purusha-Mandala, whereas the library *(Guru*) is at the south-east end. Since the museum *(Buddh)* serves to impart education, it is situated at the north-west end. The other museum is situated in the south-west direction, which is the position of man. The other blocks of *Chandra*, *Rah*u, and *Ketu* are partially under the influence of planetary positions, which are connected to each other by networks for circulation. All circulation has been planned in the positive direction, which is clockwise. The patterns for movement are further enhanced by the play of solid and void, with a mix of enclosed, semi-enclosed and open spaces.

5.4 The temple complex at Angkor Wat, Combodia

Khmer religious and architectural practices were profoundly influenced by the development of Hinduism on the Indian subcontinent during the centuries before and after its initial contact horizon with Southeast Asia early in the 1st Millennium C.E.*(Dokras,Dr. U.,2020*), Angkor Wat is a Hindu-Buddhist temple in Cambodia and the largest religious monument in the world. It uses the principles of Vastu-Shastra like the utilization of circles and squares grid architecture as well as the incorporation of the cardinal direction in the design. (Fig. 6.)

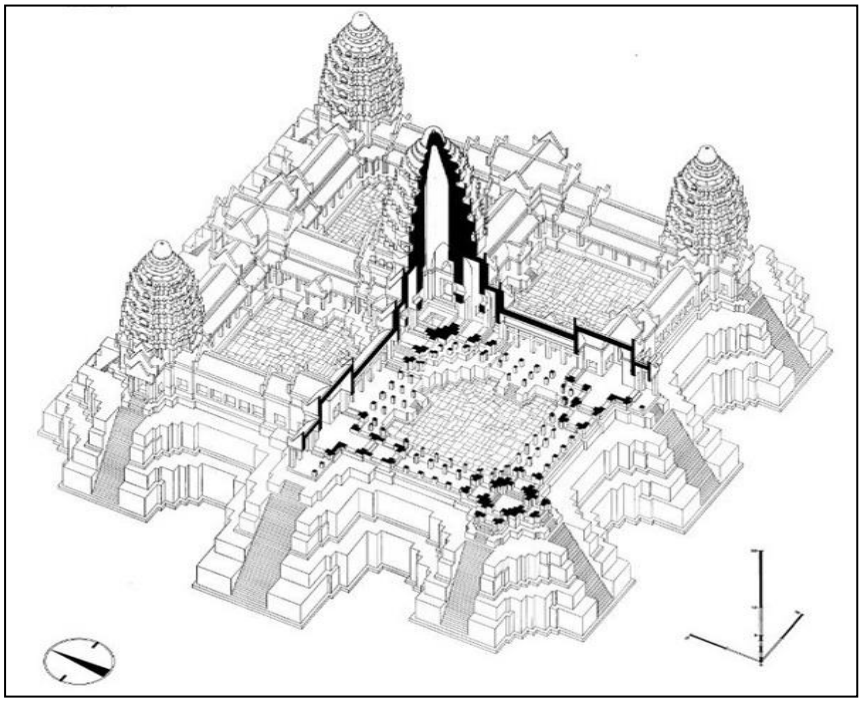

Fig. 7. Diagram of Angkor Wat temple complex (Dokras, Dr. U, 2020)

One of the main principles of Vastu-Shastra that the structure incorporates is the response to the environment and climate in its design. The usage of various environmental features such as water, plants, indigenous materials, and natural shapes and forms enables the design to be biophilic. It also incorporates the effects of solar radiation, the earth's magnetic fields, the intensity and direction of wind, gravitational force, and geo-pathic zones where fault lines with different mineral deposits interact with water to create electrical charges in its design.

According to the principles of Vastu-Shastra, energy lines run like a large grid across the earth, from North to South and from East to West. As a result, the living and working spaces have been designed in accordance with these cardinal directions to strongly influence the users. The design of the structure is built according to the five elements of nature- earth, fire, water, air, and space. The intention of the design is to tune the internal energy currents in the physical bodies of the people in the structure with the universal energy to bring in good health, wealth, and happiness.

The temple complex has incorporates other design parameters like the use of indigenous materials, geomorphology, natural materials, and landscapes to connect Vastu-Shastra to the environment. The design clearly reflects a place-based or vernacular dimension, such that the buildings and landscapes connect to a particular geographical area or context. The orientation to landscape evokes a sense of being a part of the site and being embedded within local settings, instead of separating from it.

5.5 The temple complex of Wat Phu, Laos

Vat Phou or Wat Phu is a complex of the ruins of Khmer Hindu temples, situated in Southern Laos. It is a popular, ancient place of worship that housed a temple, sanctuary, and sacred spring which served as an offering place. It comprises structures and temples that have been built as early as the 5th century BCE, although most of the surviving buildings date from the Angkor period, in the 11th and 12th centuries. The temple has a unique structure, in which the elements lead to a shrine where a *Lingam* dedicated to Lord Shiva was bathed in water from a mountain spring. The site was then converted to a center of Theravada Buddhist worship, as it is to the present date.

Fig. 8. Sketch of Lingaparvat, Wat Phu, Southern Laos (Dokras, Dr. U, 2024)

Following the principles of Vastu-Shastra, Wat Phu is oriented towards the east. However, the axis is tilted by eight degrees towards the south, being determined primarily by the orientation of the mountain and the river. This clearly displays the fact that Vastu-Shastra guidelines are prescriptive but not limiting. Response to the context is a primary rule of Vastu-shastra. Two palaces stand on a terrace on either side of the axis, and are termed as the North and South palaces, serving to be the places of residences for men and women respectively. Each palace consists of a rectangular courtyard with a corridor and entrance on the side towards the axis, and false doors at the East and West ends. The courtyards function as the voids in the middle (Brahmasthana). The next terrace has a small shrine to *Nandi* (Shiva's mount) to the South. The road connecting Wat Phu to Angkor ran South from this temple. The path culminates in seven sandstone tiers which rise to the upper terrace and central sanctuary. The sanctuary is in two parts. The front section, of sandstone, is now occupied by four Buddha images, while the brick rear part, which formerly contained the central *Lingam*, is empty.

5.6 The temple complex of Prasat Preah Vihear, Cambodia

Preah Vihear Temple is an ancient Khmer Hindu temple situated in Cambodia. As a key edifice of the empire's spiritual life, Preah Vihear Temple was supported and modified by successive kings and thus, bears elements of several architectural styles. It is unusual among Khmer temples to be constructed along a long North-South axis, rather than having the conventional rectangular plan with an orientation toward the East. Again, here it is evident that the design parameters prescribed in Vastu-shastra are contextual. On 7 July 2008, Preah Vihear was listed as a UNESCO World Heritage

Site. The temple was built at the top of Poy Tadi, a steep cliff in the Dângrêk Mountain range that is the natural border between Cambodia and Thailand. It is 140 km from Angkor Wat and 418 km from Phnom Penh.(Fig. 8.)

The temple complex runs 800 m (2,600 ft) along a North-South axis, facing the plains to the North, from which it is cut off by the international border. It consists of a causeway and steps rising up the hill towards the sanctuary, which sits on the cliff-top at the Southern end of the complex (120 m or 390 ft above the northern end of the complex, 525 m or 1,722 ft above the Cambodian plain and 625 m or 2,051 ft above sea level). Although this structure is very different from the temple mountains found at Angkor, it serves the same purpose as a stylized representation of *Mount Meru*, the holy mountain. The approach to the sanctuary is punctuated by 5 *Gopuras* or gateways (these are conventionally numbered from the sanctuary outwards, so *Gopura* no. 5 is the first to be reached by visitors). Each of the *Gopuras,* before the courtyards is reached by a set of steps and so marks a change in height. The *Gopuras* also block a visitor's view of the next part of the temple until they pass through the gateway, making it impossible to see the complex as a whole from any one point. The 5th *Gopura*, in the Koh Ker style, retains traces of the red paint with which it was once decorated, although the tiled roof has now disappeared. The 4th *Gopura* is more recent, from the Khleang/Baphuon periods, and has on its Southern outer pediment "one of the masterpieces of Preah Vihear" *(Freeman, p. 162):* a depiction of the Churning of the Sea of Milk or *Sagar Manthan* as mentioned in the *Vedas.* The 3rd is the largest and is also flanked by two halls. The sanctuary is reached via two successive courtyards, in the outer of which are two libraries.(Fig 8.)

Fig. 9. Photograph of Temple complex at Preah Vihear (Office of the Council of Ministers, 2010)

Situated on the edge of a plateau that dominates the plain of Cambodia, the Temple of Preah Vihear is dedicated to Shiva. The Temple is composed of a series of sanctuaries linked by a system of pavements and staircases over an 800-metre long axis and dates back to the first half of the 11th century AD. Nevertheless, its complex history can be traced to the 9th century, when the hermitage was founded. This site is particularly well preserved, mainly due to its remote location. The site is exceptional for the quality of its architecture, which is adapted to the natural environment and the religious function of the temple, as well as for the exceptional quality of its carved stone ornamentation.

6. Analysis, Discussion and Inferences

Table 1. Comparative Analysis of Principles of Vastu Shastra to Case Studies

Principles of Vastu Shastra	case study 1 City of Jaipur, India	case study 2 City of Chandigarh, India	case study 3 Jawahar Kala Kendra, India	case study 4 Angkor Wat Temple Complex, Cambodia	case study 5 Wat Phu Temple Complex, Laos	case study 6 Prasat Preah Vihear, Cambodia
Orientation (*Diknirnay* a)	✓	✓	✓	✓	✓	✓
Site Planning (*Vastu-Purusha-Mandala*)	✓	✓	✓	✓	✓	✓
Proportions (*Hastalakshana*)	✓	×	×	✓	✓	✓
6 canons (*Ayadi-Sadvarga*)	✓	×	×	✓	✓	✓
Aethetics (*Sadschandas*)	✓	×	×	✓	✓	✓
Historical roots	✓	✓	✓	✓	✓	✓
Architectural Influence on the region	✓	✓	✓	✓	✓	✓
Use of Local Material	✓	✓	✓	✓	✓	✓
Response to Climate	✓	✓	✓	✓	✓	✓
Philosophical, Spiritual and cultural connection	✓	✓	✓	✓	✓	✓
Continued Relevance	✓	✓	✓	✓	✓	✓

The comparative analysis of the Vastu shastra principles to the built architecture of the case studies presented in this research, point to the fact that Vastu Shastra had a strong influence on the architecture and the life of the region of India and the Indian sub-continent of South-East Asia. It was predominantly used in not only the ancient planning schemes but also, the not-so-recent, architecture and planning projects. The relevance of Vastu-Shastra is due to its relation to environmental response and sustainable recommendations which has not only allowed the ancient structures to survive through the centuries, but also allowed the not-so-recent ones to be enjoyed and adapted by the generations of inhabitants using them. Part of the reason Vastu Shastra has remained in use for so long is its flexibility. The design matrix allows for adaptation: with new building materials, in more crowded areas, and in non-square spaces. *(Dokras, Dr. U, 2020)*

Centuries of commercial and cultural interaction between the Indian kingdoms and the Khmer Empire led to a fascinating cultural exchange and enrichment, which is obvious in the magnificent motifs and architectural styles of the temples in both countries. Both Hinduism and Buddhism carried over from India to various parts of Southeast Asia during the early Christian era.

However, the most influential period of the Indian culture on Cambodian art was during the rule of Pallavas (3rd to 9th centuries) and Cholas (9th to 13th centuries). The cultural influence from the various reigns of Indian kings led to a pervasive influence on the art and architecture of Cambodia. Here, we can see the heavy Indianisation impact on the architecture and art scene in the Khmer empire. *.(Dokras, Dr. U, 2020)*

In modern cities, there is still a demand for Vastu-Shastra principles in various contexts, driven by cultural beliefs, personal preferences, and a desire for holistic living environments. Many people, particularly those with cultural ties to India or a belief in Vastu-Shastra, seek to incorporate its principles into their homes and workplaces. For them, following Vastu guidelines is a way to maintain cultural traditions and ensure harmony and prosperity in their living spaces. They believe that adhering to *Vastu-Shastra* principles can positively impact their physical and mental well-being which echoes the recent architectural theories relating *'Neuroscience'* with architecture. Design spaces that optimize energy flow, natural light, and spatial arrangements according to *Vastu-Shastra* guidelines, also result in energy-saving and reduction in the carbon footprint. As Indian diaspora communities spread across the globe, interest in *Vastu-Shastra* has extended beyond India's borders. People of Indian origin living in different countries seek to incorporate Vastu-Shastra principles with their universal applicability into their homes and businesses, contributing to its demand in modern cities worldwide.

7. Conclusion

Architecture represents the socio-cultural aspects of a region and recreates intangible principles into a material space. It represents the behaviour and user patterns of a society or community. It is the reflection of one's thoughts and ideology and culture as an illustration of architecture. Art and architecture become key elements to study the evolution of civilization in any place. As an aspect of cultural heritage, architecture presents a strong case for legacy to be carried forward in the future cities. As a prominent part of architectural planning and design, Vastu-Shastra, is, therefore, an important ACH for smart cities of the future, incorporating not only the values of the society but also, environment and sustainability as its basic principles.

Smart cities incorporate a number of smart technologies like Internet of Things (IoT), Cloud computing, Wireless Sensor Network (WSN), etc. Application of *Vastu-Shastra* can use 3D visualization, Geo-visualisation, Augmented Reality (AR) and Artificial Intelligence (AI) to help the future generations in smart cities to generate architecture which echoes their cultural heritage to modern use. Thus, it can be concluded that *Vastu-Shastra* can be considered as an integral part of ACH of future cities from the point of view of sustainability of smart cities.

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