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Neo- Vernacular Architecture: A Paradigm shift

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ABSTRACT

Architectural profession nowadays is embedded with sky-high carbon content; as the buildings innately possess towering embodied energy. Such issues degrade the natural environment and prove fatal for it. While trying to find the safer route, the only alternative we get is "Vernacular Architecture practice". But the fact is that in the current scenario, unadulterated vernacular practices could not be adopted due to the evolving lifestyle. Also, the influence of modernism accounts for the concealing and diminishing of vernacular principles and; consequently, deviating from the local traditions and culture too. There is an urgent need for a paradigm shift to take advantage of Vernacular Architecture principles and recent technological advancement in the construction industry to fulfill the needs of our modern lifestyle with minimal environmental impacts.

The paper aims to establish the principles and definition of "NEO-VERNACULAR ARCHITECTURE". This analytical research perceives to create a backdrop for the subject. Henceforth, exploring a path of 'Energy Efficient Architectural Practices' to attain 'Sustainability'.

Neo-Vernacular Architecture incorporates climatic considerations, local vernacular principles, modern construction techniques, and cultural adherence. Incorporation of vernacular elements would also create employment opportunities for local craftsmen and attain Socio-economic sustainability too. It is the most efficacious way to marry the past and present to reap a

sustainable future. The predominant concern of environmental degradation can also be dealt with neo-vernacular practices. The buildings when designed with the local context, rejuvenate the cultural and geographical identity of buildings. In modern times, neo-vernacular architecture is the definite solution for essential modern requirements and unnoticed vernacular principles.

1. Introduction

In the late 19th century, when the whole world was experiencing the effects of the Industrial Revolution, the 'Modernism' in Architecture stepped silently and start carving its place by replacing Sustainable Vernacular practices. It also arose due to the desire to break from the historical architectural style and to invent something new. The new global issues like the green-house effect, increased carbon footprint, Unbalancing the environmental equilibrium, etc became the point of concern for the whole world and these were the consequences of un-thoughtful use of high embodied energy building materials (like iron, glass, concrete, etc.) and ignorance of micro & macro site conditions only. Consequently, it created issues for the inhabitants as well.

The vernacular architecture was seen as an approach to achieve the desired goals. As the requirements and purposes of the buildings and users are altered; the vernacular architecture could not be practiced in its pure essence. There emerged the need to practice an architectural style that could revive the lost cultural identity of the buildings & caters to the well-being of nature without compromising the requirements of the modern times (the needs of the user and utilization of technological advancements).

The amalgamation of modern context and vernacular architecture aims to give rise to neo-vernacular buildings (Zographaki, 1986). In a general reaction to modernism in the year 1960s and 1970s, the 'NEO-VERNACULAR ARCHITECTURE' aroused and it drew on bricks and tiles, possessing an equivalent understanding of the natural environment and users' requirements (Jencks 1988). As the name suggests (Neo means new & vernacular means the use of local materials and techniques with the resilience of natural settings), neo-vernacular architectural principles are the derivatives of vernacular trends, amalgamated with modern technology and requirements. It provides equilibrium between form, function, energy consumption, technology, and natural context of the building.

Neo-Vernacular spirit contains the attitude towards low energy mode. Low energy mode refers to the building technique of certain district that acquires less energy for the construction, consumption, and operation of the building. The buildings are conceived to consume minimal energy with no disturbance to the natural environment. Neo-Vernacular entities explicitly adhere to the geographical and cultural context of the location they exist in. Local influence is witnessed in the vernacular elements of such buildings. The neo-vernacular aims at going back to the specific vernacular with technical consciousness.

This research paper is an attempt to do analytical research on the mentioned topic. It aims to uplift the sustainability quotient of the built environment. The paper is conceived as the documented foundation of neo-vernacular architecture. The study intends to extend the reliance over native architectural

practices, with no technological retardation. The adoption of neo-vernacularism would reduce the carbon footprint and embodied energy of the buildings. Also, would establish the emotional connection among buildings and habitats.

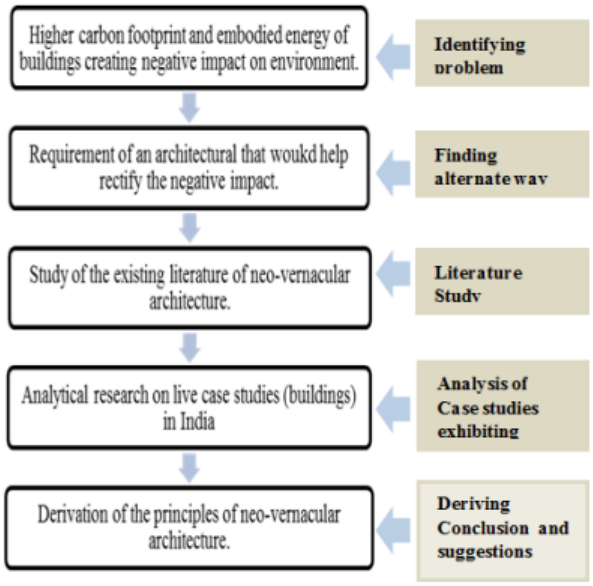

Fig. 1 Methodology

2. METHODOLOGY

Analytical research is focused on establishing the definition and principles of neo-vernacular architecture. The research concentrated on deriving methods of creating a sustainable future. The study was brought up by a thorough literature review of existing writings over the topic and analysis of live examples (case studies) designed and built by few architects in different regions of India (Fig 1).

3. VERNACULAR VS. NEO-VERNACULAR

The vernacular architecture was practiced without the supervision of professional architects, using locally available resources. The location of the vernacular building played a crucial role as it dictated the climate-responsive strategies. The vernacular architecture was predominantly practiced in pre-industrial times. Unlike today, buildings served finite purposes then, requiring minimal services.

Contrarily, in the present times, buildings are meant to serve multiple purposes. This aspect necessitates the incorporation of complex services with additional strength and stability. Thus, neo-vernacular architecture evolved as a solution, in contemporary times. 'Neo' implies to the technological advancements in the field while 'vernacular' tends to revive the ancient architectural practices.

Neo-vernacular architecture is the advanced version of vernacular architecture. It is an ideal marriage between vernacular and modern architecture reproducing alluring entities. Such buildings cater to multifaceted requirements using

vernacular principles built up utilizing the latest technology ensuring environmental conservation. Neo-Vernacular architectural practice is a holistic approach to create low impact buildings encompassing various characteristics.

CHARACTERISTICS OF NEO-VERNACULAR ARCHITECTURE

The features of the building which would enable it to be called a 'Neo-Vernacular Building' are elaborately discussed as follows: -

Cultural Adherence

The socio-cultural parameters are the primary forces establishing the spaces and relationships among them. As internal planning is influenced by the occupation and traditional legacy of the owner; the neo-vernacular spirit approaches to retain the feeling of more security and familiarity with the past. This style targets to create symbolism of what a place means to its inhabitants and visitors over time. Neo-vernacular is accomplished by renovating old forms, connecting past cultures to today's needs. Neo-vernacular acts as the remembrance of the past and vision to the future. The past is remodeled based upon existing knowledge and values to cater to contemporary essentials. (Zographaki, 1986). Emphasis is laid upon the significance it imparts to the structure and not the object itself. The alteration of the past is done to deliver the desired experience in the present. (Zographaki, 1986).

Energy Efficiency

The neo-vernacular buildings are designed to consume the least possible energy. The climatic conditions of the site govern the passive design strategies adopted. Construction of the building is carried out using local materials with minimal impact on the environment (Chahanjiri et al., 2014). The energy consumption is also reduced by determining the type of material, their embodied energy, and operational cost. The adequate exploitation of resources near the site is implemented to keep intact the natural face of the earth (Chahanjiri et al., 2014).

The low-energy mode is also attained by the setting of the building on site. The natural topography is utilized to create an energy-efficient structure. The orientation of the building is dictated to the maximum utilization of wind flow and solar movement within the site. The location of fenestration, corridors, courtyards, etc. is contingent on wind movement and solar path. Consequently, achieving adequate ventilation and sun shading to minimize mechanical energy loads.

Vernacular Influence

Unlike parent vernacular style, neo-vernacular strategies are attentive efforts of trained professionals; Whereas, the latter (vernacular style) was an outcome of prolonged community transmission of traditional values. The neo-vernacular originates from the standout aspect of specific vernacular which effortlessly accommodates contemporary needs with technical consciousness. It is a deliberate approach to reproduce distinct vernacular forms on their transformation in today's shell. A traditional form with identical circumstances is constructed utilizing modern technology, creating a new version of the past but an older version of the future or present. (Zographaki, 1986)

Neo-vernacular buildings have their own identity yet they treat historic content as something liveable and transformable. The vernacular content is altered to induce the desired experience to the building. Traditional components are used as details, volumetric solutions, or replicas of the exact old. They may also be recruited abstractly or symbolically in the contemporary context. Neo-Vernacular architecture is pluralistic, selective, and eclectic in its classical parts; as vernacular components are borrowed on knowing their innate relevance. (Mazumdar, 1995)

Coherence with ongoing practices

Since contemporary buildings cater to multiple necessities simultaneously. The incorporation of the latest construction techniques becomes compulsion when it comes to the high strength and stability demands of such buildings. Neo-vernacular principles utilize the latest technology to merge ancient design philosophies and present-day requirements. Modern techniques and traditional methods are often blended to ensure low carbon content and embodied energy. The participation of local craftsmen in building construction revives the diminishing indigenous construction methodology of remote past.

The spirit of familiarity is imparted by harnessing local building materials. Devices like color, details, paintings, finishes, etc.; are denotative. They may or may not reflect the way the structure is put up together (Zographaki, 1986). Modern construction techniques are perhaps cladded with materials that deliver the native soul to the building. The building is perceived to be in harmony with its surroundings.

Harmony with Site and Surrounding

The neo-vernacular design aspires to create unity of structure with its surroundings. The building does not dominate the natural setting rather it expresses modesty for the sense of shelter provided. The harmony among form, materials, and environment gives rise to cozy comforting emotion. The interiors and exteriors are blended during the design process to impart connectivity with the natural environment. The neo-vernacular facades are integrated with the environment and are even designed as an extension of it (Zographaki, 1986). The natural surroundings are employed to enhance the picturesqueness of neo-vernacular buildings.

Neo-vernacular architecture creates a minimum hindrance to the environment rather it embraces its existence. The micro-climate around the site is monitored by integrating substantial landscape elements during site planning. Vegetation provides the required envelope to the structure and acts as an extended enclosed space to the inhabitants. The natural topography is often exploited to save energy in the long run. Water features and cascades are frequently employed to create a comprehensive ambiance.

4. THE EXISTENCE OF NEO-VERNACULAR ARCHITECTURE IN INDIA- CASE STUDIES

Glassie says “a building may enhance its natural setting but it remains a heap of wood and stone until its analyzed”. Though the following building was not designed to fit into the principles of neo-vernacularism, but sustainable aspects like low energy consideration, local material adoption, conventional planning

techniques, waste re-usability, etc. make them a classic example of neo-vernacular architecture; thus, picturizing the buildings into a new frame. The analysis performed brings out the neo-vernacular aspects implemented in various ways within the buildings.

Few existing buildings have been adopted as case studies to analyze the established framework of neo-vernacular characteristics. These buildings were built at different periods, exhibiting the timelessness of neo-vernacular architecture. Also, these buildings belong to various climatic zones showcasing the multiple ways of incorporating neo-vernacular aspects into a building. Each case study may delineate similar characteristics of neo-vernacular architecture in a different manner but they all tend to serve a singular purpose.

CASE STUDY-1 - SANGATH

SANGATH is an Architectural and Research firm by the name called 'Vaastu Shilpa Foundation', established by Pritzker winning Indian Ar. Balkrishna Vitthaldas Doshi in Ahmedabad in the year 1980. "Sangath" is a powerful architectural manifestation of independent, original, creative Indian architecture. It is a voyage towards the rediscovery of traditional architecture in harmony with the place, people, and their past elements. The architect defines the complex as a place of "exploring artistic, social and humanistic dimensions of technology".

The aspects of the building conforming to neo-vernacular characteristics are discussed below.

Harmony with Site and Surroundings -

SANGATH is conceived with passive design strategies as dictated by the local hot dry climate. The topography has been brilliantly exploited to impart mutual shading among various components of the building. As in Fig. 2 the stepped amphitheaters on the west leads to the highest vaulted building block on the east. The vaulted enclosure on the west is set into the ground, to inculcate connectivity to the mother earth.

The strategic location of vegetation, open courts, water cascades contribute to the cooler micro-climate of the complex. Heavy vegetation is implanted on the western and southern side of the complex to naturally shade the buildings against the harsh summer sun.

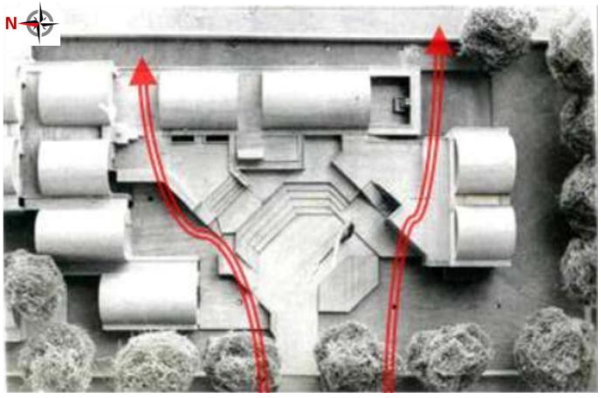

Fig. 2 Site Plan of the Complex

(Source- https://www.slideshare.net/vbarwal/sangath, April 2020)

Cultural Adherence -

The most prominent element of the structure aesthetically is adopted from traditional architecture, shown in Fig. 3. There exists a unique composition of forms i.e. the rectilinear spaces topped with curved vaults. The composition was found to obey the proportions of ancient Hindu temples. The vaulted roofs enhance the diffraction of heat rays, thus reducing the solar heat gain.

The stepped open courts and amphitheaters are used for lectures and discussion under the green canopy that surrounds and shades them, resembling Hindu ashrams.

Fig. 3 The resemblance of vaults from Ancient Architecture
(Source- https://www.slideshare.net/vbarwal/sangath, April 2020)

Coherence with ongoing practices: -

The traditional ambiance of the campus is constructed harnessing the latest construction technology. The main structural system is RCC post-beam with brick infill and RCC slabs. The barrel vaults were made using a ferroconcrete cavity sandwiched with locally available round clay tubes, resulting in better insulation properties, as in Fig. 4. The dominant vaults are cast in-situ recruiting sliding formwork. China mosaic- a waste material has been used in cladding reducing the heat gain of the structure. Multiple construction innovations were results of traditional knowledge blended with the latest resources with the continuous experimental assessment.

Fig. 4 Construction of Barrel Vault in Sangath
(Source- https://architexturez.net/doc/az-cf-168122, April 2020)

Fig. 5 Water channels and the Cascades
(Source- https://www.sawdust.online/projects/sangath-ahmedabad-balkrishna-doshi/, April 2020)

Energy-Efficient Approach: -

Sangath has been deliberately designed to interweave indoors and outdoors. Ar. B.V Doshi has made an attentive effort to bring professionals closer to nature, thus enhancing their productivity. The design and construction provide a temperature difference of 8 degrees Celsius among interiors and exteriors. The time lag of heat gain is increased by 6 hours. A reduction of 30% to 50% in cooling energy is achieved by the sustainable techniques used. Water recycling is attained by using water channels and cascades (as visible in Fig. 5). 10% of the construction cost is saved due to the non-usage finishing materials. The china mosaics were not only used to reduce energy consumption but, also to employ waste materials

CASE STUDY-2 - WALL HOUSE

'Wall House' is the name given to the residence of a sustainable Architect Anupama Kundoo. The house is 1.5 stories tall, located on the outskirts of Auroville in a tropical humid climate. The construction was completed in the year 1996. The house is an outcome of extensive research and experimentation of then ongoing study on low-impact buildings. It accommodates all the modern requirements while also absorb guests within a compact-space. The wall house has a linear plan with all the activities arranged in a row.

Harmony with Site and Surroundings: -

The house is beautifully set amid dense vegetation in all directions, evident in Fig. 6. It is oriented on the North-east and South-west axis to enhance air circulation. All activities in the house can spill onto north-east in the form of projections and alcoves, providing shade from direct sunlight. Balconies with large transparent fenestrations are provided on the western side amid the wind flow direction. These windows provide glare-free light throughout the day while capturing sunset views in the evening. The entry is recessed in northeast direction emphasizing the dominant wall of the house.

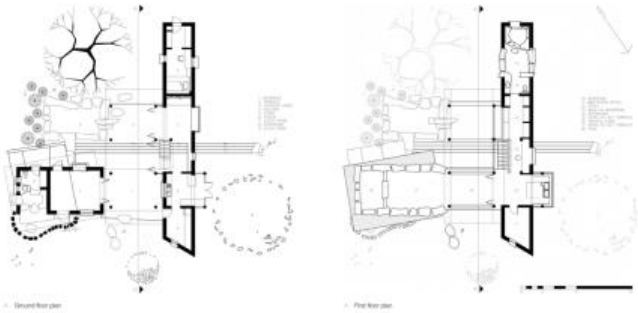

Fig. 6 Floor Plans of the 'Wall House'
(Source- https://urbannext.net/anupamakundoo/wall-house/, May 2020)

The wise use of topography is employed to create level differences among two components of the house, imparting self-shading within the structure. There is a deliberate absence of hard concrete pavings around the house, reducing the urban heat island effect on the site. The landscape has been designed as an integral and inseparable element of the house.

Cultural Adherence: -
During designing the architect has tried to replicate rural as well as the urban environment within the campus. As in Fig. 7; Pavements approaching buildings are made utilizing local materials - Bricks and Stones. The visual appearance of pavements, soil, and exposed bricks façade of the building imparts cultural adherence to the building. The rustic and natural ambiance creates a sense of belonging among buildings and the surrounding natural environment. The interiors of the house incorporate minimalistic elements providing calm and peaceful spaces among dense greens.

Fig. 7 Raw and Rustic color of the campus
(Source- https://architecturelive.in/the-wall-house-at-auroville-byanupama-kundoo-architects/, May 2020)
Coherence with ongoing practices: -
The house explicitly showcases the combination of local building materials and modern technology. Certain materials that are not conventional building materials; are used innovatively. Shown in Fig. 8; Catenary vaults made of clay tube and vessels are used as inaccessible roofs. Such vaulted spaces are built

with more height to enhance the airflow stack effect providing better ventilation.

The default RCC in contemporary constructions is used in structural elements of the house. Window frames are fabricated of steel. The exposed bricks facade is made of locally customized traditional "achakal" bricks 18cm*10cm*2.5cm in dimensions. Wall of thickness 30cm,20cm, or 10cm incorporating specially designed bonds, using lime mortar with 10% of cement for strength considerations. Scientific reasoning and analysis were applied to develop hybrid construction technology employed.

Fig. 8 Use clay vessels in vaults
(Source-https://urbannext.net/anupamakundoo/wall-house/, May 2020)

Vernacular Influence: -

Fig. 9 shows the naturally shaded 'Wall House' redefining the marriage between internal and externals spaces. Transitional spaces and boundaries are elaborated innovatively, creating barrier-free spaces. The landscape has been strategically used to merge indoors and outdoors. Large fenestrations, spill-over spaces are the connecting elements among calm, peaceful interiors, and lush green exteriors. Perforated screens are used to enhance transparency within two spaces. The house itself is shaded under dense vegetation keeping the micro-climate cool. Ventilation is also magnified due to overall coverage by trees.

Fig. 9 External View of the Wall House
(Source- https://urbannext.net/anupamakundoo/wall-house/, May 2020)

Energy Efficiency: -

The residential building is an outcome of thorough research and experimentation in areas like eco-friendly building materials and techniques, alternatives to current building practices, and energy-efficient buildings.

Fig. 10 shows; the judicious combination of RCC blended with local building materials is results in lower embodied energy and carbon footprint of the house. As required, low skilled and highly specialized laborers were employed during construction; consequently, dropping down the monetary requisites.

Dense coverage of vegetation producing cooler micro-climate has reduced the mechanical requirements of the house. The reduced energy requirements are wholly met by solar photovoltaic cells. Solar water heater and solar pumps are used to cater to water necessities.

Fig. 10 Judicious uses of different materials
(Source- https://www.anupamakundoo.com/wall-house/, May 2020)

CASE STUDY-3 - ASHAMS RAVI HOUSE

An architect's home was built using recycled materials. Thiruvananthapuram based 27 years old architect vanishes all the pre-conceptions of green buildings. Ashams Ravi designed his residence as an extension to the natural environment. It was ensured that all the material and construction techniques were eco-friendly. The extreme feature of the house is that it was designed straight away on the site. There were no architectural drawings of plans, elevations, and sections. The residence is an outcome of spontaneous thought and visualization for a sustainable home. The materials acquired from the demolition site directed the elements in the house

Cultural Adherence: -

The house has been inspired by the principles of Laurie Baker school of Architecture. The design also exhibits the influence of Christian philosophy. As the living area roof connects to the prayer area with a gothic arching roof. The holy cross in the prayer space is made using beer bottles. The conventional courtyard planning is adopted additional ventilation creating a space for gatherings with additional ventilation. A small water element is also provided within the courtyard as considered pious in Indian culture. Fig. 11 shows the use of traditional elements in the house.

Fig. 11 Use of traditional elements
(Source- https://www.magzter.com/news/954/2474/042020/8a525,May 2020)

Fig. 12 Interior of a bedroom in the house
(Source- https://www.magzter.com/news/954/2474/042020/8a525, May 2020)

Coherence with ongoing practices in terms of internal planning: -
The building incorporates modern requirements, as it is the main intent of ongoing architecture practice. The vernacular looking two-story house has a demarcation of private and public spaces in the house to make integrated, cohesive spaces. The entrance to the house passes through a spacious sit-out. The living room extends to the dining area and workspace. The dining area is accompanied by an open kitchen. The workspace doubles up the veranda area. The ground floor has two rooms with attached bathrooms. The first floor of the house has a library with a courtyard, open-terrace, and two bedrooms with attached bathrooms. The interior of the bedroom is shown in Fig. 12.
The architect supervised the design and construction on site.
Harmony with Site and Surroundings: -
Ashams Ravi is professionally a sustainable architect. He approached the green route to design his own house. The house is built on inclined land while all the trees are retained during construction. The slanted land was not even leveled

and the construction started straight away. The big mahogany tree which stood right in the middle of the plot is now 'Centroid' of the house. The 5662.8sq ft plot houses 2500sq ft houses 'Canaan' meaning 'promised land'; leaving more than half of the plot for landscape incorporation; evident if Fig. 13.

Fig. 13 Incorporation of the landscape around the house.
(Source- https://www.magzter.com/news/954/2474/042020/8a525, May 2020)

Energy-Efficient Approach: -

This sustainable residence was built with bamboo and 90% waste materials within 4 months. The list of recycled materials used included beer bottles, bricks, cartwheels, doors, bricks timber, Mangalore tiles, terracotta tiles, sourced from a demolition site. The young architect adopts maximum sustainability skills from COSTFORD. The material from someone's trash proved treasure for the young architect. The use of cement is minimal as it possesses high embodied energy.

Material from trash - beer and alcohol bottles were repurposed to make lampshades and art installation (in Fig. 14). There an entire wall made of using beer bottles and plastered with mud. The hall designed for informal gatherings has a unique floor composition. It comprises of cow dung which is layered over bamboo slabs and jute sacks with very little cement for bonding.

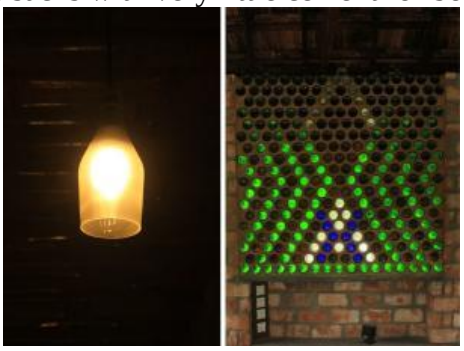

Fig. 14 Reuse of beer and alcohol bottles
(Source- https://www.magzter.com/news/954/2474/042020/8a525,May 2020)

The main door of the house is utilized from the ruins of the palace of Diwan of Travancore. Railings and doors were used after scratching away paint. The brass railings being less prone to corrosion were used as it is. The large cartwheel used in races at Pongal is now a window frame in the house (in Fig. 15).

Due to the higher tensile strength of bamboo (28,00 pounds per sq. inches) than steel (23,000 pounds /sq. inches). After the insect repelling treatment with

borax, bamboo formed the skeleton of the structure. Trunks of coconut trees were used as load bearing members after being treated in the same way.

Fig. 15 Unique use of waste materials
(Source- https://www.magzter.com/news/954/2474/042020/8a525,May 2020)

Coherence with ongoing practices in terms of materials and construction: -
Apart from recycling building materials, construction techniques used also ensure the judicious use of resources. The rat -trap bond went through an innovation. The bricks were placed vertically instead of horizontal placement increasing cavity in the wall, raising time lag (evident in Fig. 16). Consequently, the cost of masonry was reduced by 30%. The temperature of the interiors is compensated for up to 3 degrees Celsius. The house has a biodigester tank to collect waste from the kitchen and toilets through underground pipes. The inclination in the land was utilized to take water to the rainwater harvesting tanks at the downwards slope. During monsoon, the overflow drainage hole from the rainwater harvesting tank leads the water to wetland constructed to recharge groundwater.

Fig. 16 Innovated Rat trap bond in walls and columns
(Source- https://www.magzter.com/news/954/2474/042020/8a525, May 2020)

Despite all the spontaneity during the process, there was always a clear visualization and conceptualization of sustainability.

CASE STUDY-4 - IIHMR UNIVERSITY, JAIPUR

The 14.37 acres campus for the Indian Institute of Health Management and Research University, Jaipur was designed by Architect Ashok B. Lall and Associates in the year 1988. The main campus consists of an academic block, a computer center, library and documentation center, a management and development programmed center, an auditorium, conference and seminar rooms. The architect blended spaces using a sustainable approach. The architectural characteristics of the campus ensure better productivity of students by unintentional use of neo-vernacular principles.

Harmony with Site and Surroundings: -
The natural undulated terrain provided the rationale for site planning. Because low lying areas are less water-deprived, they were assigned with residential and institutional components. Seasonal drainage passing through the site divided the campus into academic and residential halves. The two halves are designed using courtyard planning enhancing interactions among students and faculty (in Fig. 17). Courtyards and entrance forecourts are only open spaces with deliberately designed landscape elements. Remaining open spaces are planted with indigenous bushes and left to grow wildly.

Fig. 17 Google earth top view of the campus
(Source- https://cdnimd.worldarchitecture.org/extuploadc/1-374, April 2020)

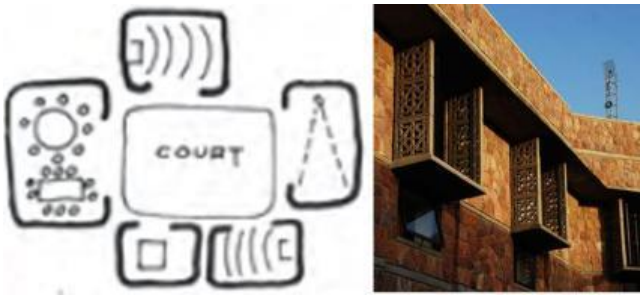

Fig. 18 Traditional practices adopted in the campus
(Source- A+D, Mar-Apr, 1993, May 2020)

Vernacular Influence: -

The IIHMR campus is situated in Jaipur, exhibits the conventional design elements in the region. Native courtyard planning has been adopted to provide better ventilation and interaction opportunities for users. Ventilation is also enhanced by using Jaalis as a window frame. Such jaali frames capture glare-free light and cooler air into the rooms. Fig. 18 shows the conventional practices adopted during the design of the campus.

Locally available pinkish-grey granite and some other local stones were quarried from nearby villages. Native craftsmen were employed during the construction.

Energy Efficiency: -

The campus is situated in the hot semi-arid climate of Jaipur, exhibits the adoption of passive cooling strategies. Except for a few air-conditioned rooms, all the workspaces are employed with a built-in evaporative cooling system to provide thermal comfort at a very little cost. There is a deliberate approach evident to create a cooler micro-climate (in Fig. 19). Walkways leading to building blocks are provided with pergolas, shaded with creepers. The incorporation of grass with paving reduces the urban heat island effect around the building blocks.

Coherence with ongoing practices: -

The contemporary structure of the campus is cladded with locally available pinkish-grey granite and similar stones (in Fig. 20). On the walls of the structure, are located low-height glazing panels to impart better glare-free daylight. Thus, reducing energy consumption. The electrical energy requirements of the campus are fulfilled by the installation of contemporary solar panels.

Fig. 19 Pergolas shaded with creepers (left); paving accompanied with grass (right)

(Source- https://worldarchitecture.org/architecture-news/epnfh/ashok-b-lall-s-iihmr-jaipur-is-an-exemplar-of-critical-regionalismenvironmental-sustainability.html, May 2020)

Fig. 20 Building cladded with stone and solar panels on the rooftop (Source- A+D, Mar-Apr, 1993, May 2020)

CASE STUDY-5 - MIRAMBIKA SCHOOL, NEW DELHI

Mirambika school founded in the year 1981 was designed by SHiFT studio – Studio for Habitat Futures, the extreme climate of New Delhi. The project was conceived as a place to hold an innovative program of education, research training, and scholarships. The proposal included the brutal-looking structure rendered with greenscape. The low-energy approaches, integration of natural and built environment, user-friendly design built using modern concrete construction has imparted such features, which coincided with the 'Neo - Vernacular' approach.

Cultural Adherence: -

A free progress school is an alternative education platform based on the integral philosophy of Sri Aurobindo and his mother. It is situated on the campus of Sri Aurobindo Ashram, New Delhi. The campus is based on the belief that each individual comes onto earth for an evolutionary cause and corresponding potentials. The learning process in school stresses on child-centric, value-oriented development in a spiritual environment. The calm, quiet spiritual environment is established using dense vegetation around the building block. The Mahabodhi tree is planted in the central court of the school adding to the spiritual quotient (see Fig. 21).

Fig. 21 Maha-bodhi tree in a bigger central court of the school. (Source- https://architizer.com/projects/mirambika-school/, May 2020)

Coherence with ongoing practices in terms of internal planning: -
The school has an open plan following the education provided. Rooms and spaces are organic amorphous. The building is planned on a modular grid of a basic structural dimension of 7.2 m, with concrete ribs subdividing the slab into eight or four equal panels. There are very few permanent walls to any of the ribs of grid spaces. Such walls were designed intentionally to create barrier-free spaces.
The electrical services redundantly placed in the ceiling can be dropped down at any location as per flexible room arrangement. Spaces that require plumbing services are placed at inflexible rigid locations on the grid. Such spaces include restrooms, water-points, dining areas, kitchens, laboratories, and alike.
12 dodecagonal building blocks are arranged around a central courtyard resulting in a bigger dodecagon. Each of the 12 blocks is perceived as one side of the bigger dodecagon. The 9 building blocks out of 12 have an open-to-sky court in the center which is further catered by a bigger courtyard. Rest 3 has an auditorium, gymnasium, and dining court as covered spaces. (see Fig. 22)

Fig. 22 Ground floor plan of Mirambika School
(Source- https://architizer.com/projects/mirambika-school/, May 2020)

Coherence with ongoing practices in term of construction: -
The brutal looking building is made of contemporary materials - RCC, Steel, and Glass. The building is constructed using RCC with exposed structural elements. There exists minimal cladding within the structure using china mosaic, terrazzo, and locally available stones, in combination with concrete imparting a similar appearance. Minimalism is also evident in the simplistic staircase railing made of steel. Steel is also used with glass in full height windows, connecting inside and outside. Fig. 23 shows the interiors of the school building.

Fig. 23 Minimalistic interiors of a building block in Mirambika School (Source- https://shift.org.in/mirambika.php, May 2020)

Fig. 24 Densely vegetated courtyard accompanying water body (Source- https://shift.org.in/mirambika.php, May 2020)

Energy-Efficient Approach: -

There has been a conscious approach to create a cooler micro-climate within the campus. The courtyards are planted with plenty of trees making easier ventilation in the extreme climate of New Delhi. Plantations are also accompanied by water bodies to make a better way for cooler air (in Fig. 24). Maximum land is left as softscape except for the star-shaped pavements. Softscape is not limited to the ground only. Creepers are planted on the lintel level of the building and left to grow down freely along with the structure. The presence of organic creatures over the structure reduces the heat gain from the harsh summer sun.

CASE STUDY-6 - CII SOHRABJI GODREJ GREEN BUSINESS CENTRE, HYDERABAD

The CII (Confederation of Indian Industry) – Sohrabji Godrej Green Business Centre in Hyderabad was designed by Karan Grover and Associates in the year 2004. It is the first LEED Platinum rated building in India. It offers advisory services to the industry in the areas of Green buildings, Energy Efficiency, Water Management, Environmental management, Renewable energy, Green business incubation, and Climate change activities. The building is a perfect blend of India's rich architectural splendor and technological innovations,

incorporating traditional concepts into modern and contemporary architecture (Council, 2020).

Energy Efficiency: -

The Architect's team has focused on the minimum energy consumption within the building. Extensive energy simulation was carried out to find the appropriate orientation of the building to ensure minimum heat ingress and maximum daylight. 20% of the building energy requirements are catered to by solar photovoltaics, 35 % reduction in potable water consumption, and usage of 80% of recycled / recyclable materials. Building Management Systems (BMS) were installed for real-time monitoring of energy consumption. Thus ensuring 50% saving in overall energy consumption.

Vernacular Influence: -

The use of traditional courtyard planning and jaali (perforated wall) is evident in the structure. Courtyards are employed as light wells to provide abundant daylight and ventilation. Perforated walls (Jaalis) have also been used to make ventilation and daylight better. These walls ensure minimum glare and heat gain while providing adequate lighting and views. Jaali wall is surrounded by plantations on the interiors. These plantations receive rainwater through jaali pores in the rainy season (in Fig. 25).

Coherence with ongoing practices in terms of technology: -

The latest technology has been utilized to make this green building. Roof garden absorbs heat falling on the roof, thus reducing thermal heat gain in the building. Fig. 26 shows the function of a green roof when rain falls over it. The usage of reflective glass and double-glazed glass reduces the penetration of solar heat rays. Wind systems consisting of evaporative cooling and wind towers are used to make the air cool. Solar photovoltaic cells are also installed to capture solar energy. Furthermore, recycled materials are employed to reduce the carbon footprint and embodied energy of the building.

About 77% of materials used during construction are salvaged from other construction sites. Recycled content includes fly-ash bricks, paper, aluminum, broken tiles, a cinder from industrial furnaces, bagasse from sugar cane industry, mineral fiber, cellulose fiber, quarry dust, etc.

COMPARATIVE STUDY OF CASE STUDIES

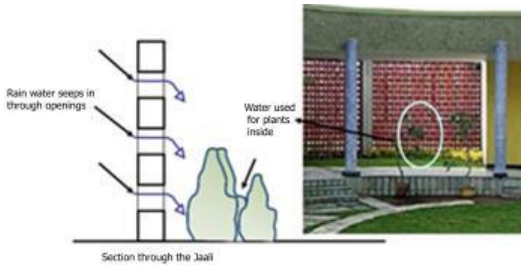

Fig. 25 Function of the perforated wall (jaali) in the building (Source- https://www.slideshare.net/gauravjhunjhunwala89/sohrabji-godrej-green-business-centre, July 2020)

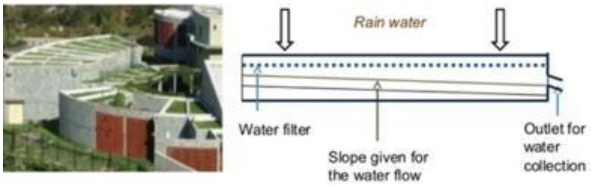

Fig. 26 Function of green roof in building
(Source- https://www.slideshare.net/gauravjhunjhunwala89/sohrabji-godrej-green-business-centre, July 2020)

Harmony with Site and Surroundings: -
The built form of the campus has evolved from aspects observed to be intrinsic among nature of the site and nature of the building. Arrangement of spaces was determined by the presence of rocks on site. Further, contours dictated the level differences within the building. There has been a deliberate approach towards minimum disturbance to the natural environment throughout the project.
The disturbance to the site was limited within 40 feet from the building footprint during the construction phase. This has preserved the majority of the existing flora and fauna and natural microbiological organism around the building. Extensive erosion and sedimentation control measures to prevent topsoil erosion have also been taken at the site during construction.

Although all the above-discussed case studies were designed by their Architects without deliberate attempt towards the Neo-Vernacular approach, still their features are aligned with this in one or the other way. How their different features are moving towards the common goal through different ways has been summarized in Table 1.

5. CONCLUSION

The study was initiated with the intent of finding a solution for a sustainable built environment. The research focused on delineating the methods of reducing carbon footprint and embodied energy of buildings with due respect to technology advancement and user's need.

The amalgamation of the latest technology- "Neo" and ancient architectural practices- "Vernacular"; was adopted as an appropriate solution for achieving the aim. Neo-vernacular architecture has been defined as "the interweaving of on-going latest trends in the profession with ages-old vernacular practices of identical circumstances".
The research concludes that the cultural background, geographical location, and site conditions play a pivotal role and rationale for its planning in the Neo-vernacular Architecture approach. It governs the selection of climate-responsive strategies, vernacular principles, locally available materials, and their specific construction methodology, elements of cultural identity, and alike. These elements may be incorporated in different buildings in a different manner, but the principles remain singular. Certain principles have been enlisted to create a neo-vernacular entity: -

The buildings cater to the user requirements satisfactorily.
Adoption of specific vernacular features with adequate adulterations as per contemporary needs.
Construction is done utilizing ongoing technological advancements (construction techniques, building materials, etc.), regardless of the time of building erection.
There exists a conscious approach to blend building with natural surroundings while creating minimal interference to the environment.
Energy efficiency measures are considered during the planning, construction, and operation of the building.
Emphasis is laid on employing locally available materials and skills acquired from the nearest possible distance.
The ambiance inside and around the building is created to impart an experiential sense of cultural belonging to the inhabitant.

The all above features can be grouped in 05 major heads to define the characteristics of Neo-Vernacular Architecture; those are Cultural Adherence, Energy Efficiency, Vernacular Influence, Coherence with ongoing practices, and Harmony with the site & surroundings.
These major heads may be incorporated in a different perspective in different buildings.

Table 1. Comparison of principles of Neo-Vernacular Architecture in the adopted 06 case studies

Table 1. Comparison of principles of Neo-Vernacular Architecture in the adopted 06 case studies					
Principles / Case Studies	**Harmony with Site and Surrounding**	**Cultural Adherence**	**Coherence with ongoing practices**	**Energy Efficiency**	**Vernacular Influence**
Case Study-1 Sangath, Ahemdabad	Mutual shading within various components and strategic location of vegetation	Stepped open courts and amphitheaters, resembling Hindu Ashrams	Barrel vaults made using ferroconcrete cavity sandwiched with locally available materials	A temperature difference of 8 degrees Celsius among interiors and exteriors	Rectilinear building blocks topped with traditional vaults.
Case Study-2 Wall House, Auroville	Oriented on North-east and South-west axis enhancing air circulation.	The rustic & natural ambiance created a sense of belonging among building & the natural	Catenary vaults made of clay tube & vessels; walls made of customized bricks & specially	Energy requirements wholly met by utilizing solar power	Perforated screens are used to enhance transparency within indoors and outdoors.

		environment	designed bonds		
Case Study-3 Ashams Ravi House, Thiruvananthapuram	Built on existing inclined land while all trees are retained during construction.	Living area roof connecting to prayer area with gothic arching roof & holy cross	Demarcation of private & public spaces in the house to make integrated, cohesive spaces.	Built with bamboo & 90% waste materials within 4 months	Central courtyard planning adopted to reduce heat gain
Case Study-4 IIHMR University, Jaipur	The designer permitted the seasonal drainage to divide the campus into academic and residential halves.	-	Cladded with locally available pinkish-grey granite & similar stones	Built-in evaporative cooling system to provide thermal comfort	Native courtyard planning & perforated walls(jaali)
Case Study-5 Mirambika School, New Delhi	Based on the belief of Sri Aurobindo and Mother	Stresses on child-centric, value-oriented development in a spiritual environment	Flexible walls with very few permanent ones	Densely planted vegetation eases ventilation & cooler micro-climate	Traditional courtyard planning adopted
Case Study-6 CIIGBC, Hyderabad	Disturbance to site limited within 40 feet from the building footprint during the construction phase.	-	Techniques like green roof, solar cells, double glazed windows used	Usage of 80% recycled/ recyclable materials. 50% saving in overall energy consumption	Courtyard planning & perforated wall used for ventilation & daylighting

6. SCOPE OF FUTURE RESEARCH

During the research, it was observed that neo-vernacular practice is limited to low-rise structures. Since a high rise building caters to an enormous number of users, a more rigid and complex structural system is used; they tend to deviate from neo-vernacular trends. There is a need to lay more emphasis on the sustainability quotient of high-rise structures. Such buildings can be made more sustainable by incorporating neo-vernacular principles to the maximum possible extent.

Further research can be done to find possible ways of making sustainable High-rise structures through the Neo-Vernacular approach.

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