

India's Indigenous Blueprint for Sustainable Living

By Dr. Neha Sharma

Long before "Science Tourism" entered mainstream policy conversations in India, the **Vigyan Setu Foundation** had spent more than a decade building its modern Indian framework. The foundation's Managing Trustee, Dr Lalit Sharma, did not simply borrow a global travel category; they reshaped it. Where the term had typically pointed to research laboratories and ecological hotspots, they widened it to include the decoding and protection of our scientific heritage, encouraging visitors to see India's famous historic monuments through the lens of physics, engineering and astronomy.

While Science Tourism is a global concept, it was the **Vigyan Setu Foundation** that anchored it in India, championing it well before 2020 as a vital tool for public science communication and heritage preservation. As this article explores the intersection of travel and discovery under the theme of Sustainability Pathways, we owe the Foundation and Dr Sharma a real debt of gratitude for shifting how we look at our rich scientific heritage. It is in that spirit that this article reads India's built heritage as a body of engineering, and as a guide to building sustainably today.

Much earlier than the rise of "sustainability" as a design framework, India's builders were deeply fluent in its philosophy. Across deserts, coastlines, mountains, and floodplains, vernacular architecture evolved

not from certification checklists but from necessity arising from communities reading their climate, their soil, and their materials with extraordinary precision. As the built environment sector scrambles to decarbonise, there is a quieter, more overlooked opportunity: looking backward before looking abroad.

Water as the First Design Brief

In Rajasthan and Gujarat, water scarcity produced some of the most sophisticated hydrological architecture in the world: the stepwells, or *baolis*. Structures like *Rani ki Vav* or *Chand Baori* are often admired for their geometry, but their real genius is thermal and ecological: descending storeys of stone create a cool microclimate even in punishing heat, while the well itself recharges groundwater and buffers seasonal drought. These weren't just wells; they were community infrastructure, social space, and climate control rolled into one.

Similarly, the *Charbagh* garden systems and stepped tanks across the subcontinent treated water circulation as inseparable from architectural planning, which is a lesson, modern urban design is only now relearning through the language of "blue infrastructure."

Passive Cooling before Air Conditioning

The perforated stone or lattice screens, better known as the *jaalis*, seen in Rajasthani

havelis is a masterclass in passive design. By diffusing sunlight and accelerating air movement through the Venturi effect, *jaalis* cool interiors without mechanical intervention, while also managing privacy and glare. This single architectural element performs simultaneously as climate control, light modulation, and cultural expression.

In the hot-humid south, the courtyard house (*nalukettu* in Kerala, *chettinad* homes in Tamil Nadu) uses a central open-to-sky courtyard to drive stack ventilation, where the hot air rises and escapes, pulling cooler air through shaded verandas below. Deep eaves and sloped tiled roofs manage monsoon rainfall while shading walls from direct heat gain. None of these required imported HVAC thinking; it required attentive observation of airflow and sun path.

Material Intelligence

Perhaps the most quietly radical aspect of Indian vernacular building is its material restraint. Mud, lime, bamboo, thatch, laterite, and cow-dung plaster were not "low-tech" compromises. They were high-performing, locally sourced, biodegradable, and thermally intelligent choices. Laterite stone in coastal Kerala breathes with humidity. Lime plaster, unlike cement, allows walls to regulate moisture rather than trap it, reducing damp and extending building life. Bamboo, now being re-engineered in labs as a "future material," was already load-bearing architecture in the Northeast and Western Ghats centuries ago.

Even agricultural residues including jute, coir, husk and the likes, found their way into construction and insulation, an early form of

circular economy where waste from one system became input for another. This resonates strongly with today's push toward bio-based acoustic and thermal materials, an area where the built environment is still catching up to what artisanal knowledge encoded generations ago.

Built to Survive

High-Altitude Passive Solar Design

In Ladakh, traditional homes flip the passive strategy entirely: thick rammed-earth or mud-brick walls store heat, small deep-set windows minimise loss, and south-facing orientation with sun-trapping courtyards captures maximum solar gain in a high-altitude desert. This is passive solar design, executed without a single simulation software, refined instead through generations of trial, error, and inherited memory.

Engineering for Earthquakes

Vernacular builders were not only responding to heat and water; they were also engineering for survival. In Kutch, the circular *bhunga* houses, with their mud walls, lightweight conical thatched roofs and a round plan that leaves no vulnerable corners, became well known for how many of them stood through the devastating 2001 earthquake while rigid masonry around them failed. In Kashmir, *dhajji dewari* construction laces a timber frame through masonry infill, so the walls can flex and dissipate seismic energy rather than resist it until they crack. Both systems accept movement instead of fighting it, which is a principle modern seismic codes arrived at through very different means.

Adapting to Floods and Slopes

In the flood-prone plains and hills of the Northeast, the answer is lightweight bamboo architecture raised on stilts. Lifting the living floor above rising water lets floods pass beneath the house, while bamboo's flexibility and low weight make the structure forgiving under stress. The same stilted typology also adapts to sloping ground with minimal excavation, which is useful in landslide-prone terrain. If a house is damaged, it can be repaired or rebuilt from locally grown material.

Resilience as Sustainability

There is a sustainability argument here that is easy to overlook: resilience is itself a form of low-carbon design. A building that survives a hazard does not need to be rebuilt, and one made of light, natural, repairable materials does far less harm when it is stressed to its limits.

Reviving Indigenous Architecture

The risk in "reviving" indigenous architecture is treating it as a nostalgic aesthetic rather than functional system. The real opportunity lies in extracting the underlying principles such as passive thermal regulation, water-sensitive design, hazard-resilient construction, hyper-local material sourcing, adaptable community-scale infrastructure,

and re-embedding them into contemporary practice, codes, and specification culture, rather than merely referencing them as heritage motifs.

This also means taking indigenous knowledge seriously as engineering, not folklore. Many of these systems were never formally documented in journals or standards, but they were empirically tested over centuries, at scale, under real climatic stress. That is arguably a more rigorous dataset than most modern products can claim.

As the built environment searches for its sustainable future, some of the most useful answers may not need inventing. They need remembering and then translating into the specifications, certifications, and building codes that shape what gets built today.

Whether you are seeking to explore the depths of Science Tourism or looking for the right tools to communicate it to your audience, I strongly encourage you to reach out to **Vigyan Setu Foundation**, the pioneers driving Science Tourism in India. They frequently organise online presentations and short courses on this topic

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