An Insight into Himalayan Vernacular Architecture: The Kath-Khuni Style of the Kullu Region, India

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Abstract

Vernacular architecture engages people and the community in making their dwellings in response to the environment and socio-cultural aspects, employing local resources and traditional construction methods. Most states in India show diversity in their vernacular architectural styles, linked with traditions and culture.

A unique ancient construction method, known as 'Kath-Khuni Architecture' exists in the western Himalayan region. The style suits the life style of the locals. It has evolved through generations and has many sustainable benefits like the use of local resources, climate responsiveness, low maintenance, energy efficiency, structural resilience, social and community integration, biodegradability and earthquake resistance.

Within this background, the paper examines the spatial organization and architectural characteristics of the vernacular buildings in Himachal Pradesh. It analyzes how the domestic or household functions are integrated with the house forms and spaces.

This study employs a qualitative approach, rigorous field visits, documentations of the buildings and a questionnaire survey administered among the villagers. It covers both the temple form and the residential building typology of Kullu, Himachal Pradesh.

The paper reveals several issues and challenges in practicing the Kath-Khuni style in making buildings in Himachal. Transformations are observed in architectural spaces and forms of contemporary buildings. Nevertheless, the study shows that these community-led design and construction practices create spaces, which fulfil their social needs as well as thermal comfort in response to the climate. The paper argues that such indigenous architectural styles and the vernacular settlements should be considered as cultural assets of the society. In this direction, detailed design guidelines are offered to resist the rapid transformation of built-forms of the Himalayan region, which may support the 'Kath-Khuni' vernacular style.

Keywords: Vernacular, Kath-Khuni, Cultural Practices, Spatial Organization, Built-form Characteristics.

Introduction

As the geographical condition of India varies from the North to the South and from East to the West, it has developed a wide range of vernacular architectural styles. It includes diversity in its spatial organization, materials, forms, construction techniques and so on, developed with respect to the local climate, availability of materials and socio-cultural values (Thakkar and Routh, no date). The vernacular built-forms have been developed by the local craftsmen based on their inherent knowledge and skills handed down through generations and native technologies. Vernacular architecture tries to create a link between the habitat and its cultural roots (Oliver, 2006).

As Ferrari says

> "Vernacular architecture can be seen as the result of a balancing process in which physical, environmental, cultural and formal factors are constantly related the one to the others through time. A slowly evolved practice and a long-established tradition shaped both material and immaterial aspects of past architecture".
>
> (Ferrari, 2018:16)

As Verma, Kamal and Brar (2022) point out, vernacular architecture across the globe developed through generations are the best examples of climate-resilience and energy efficiency. This study focuses on the Kath-Khuni style of Himachal Pradesh, well -known for its earthquake resistance, thermal comfort and wood carvings. However, since last decade, due to changes in the policies, socio-economic conditions and the occupational structure, this style is gradually vanishing from Himachal, even from very remote places. Jagatramka, Kumar and Pipralia (2021a) show that transformations of built environments is an inevitable process, which is a result of several factors.

The transformations are well adapted by the residents and still, they are well-connected to their socio-cultural roots. Kristal (2011) points out that the future of Kath-Khuni style is unclear. Rapid urbanization, tourism influx, infrastructure development, changes in the socio-economic scenario, occupation etc. have accelerated the disappearance of Kath-Khuni. Very few retain their centuries-old style of constructing shelters. Atrey (2019) shows that forest preservation is essential for sustainability. However people use materials for the RCC structure, which cannot provide thermal comfort. They are also structurally unsuitable for earthquake-prone zones. This questions the effectiveness of the policy. In a country like India, where so much diversity is present, the local or regional built environment should be studied, documented for the knowledge building of future generations, analyzed and well-conserved or partially transformed with respect to the need of the dwellers.

With this overview, this study aims to document and understand the spaces and forms of the kath-khuni style buildings, establish their significance in their socio-cultural context and climatic scenario and formulate design guidelines to resist the rapid transformations of the built-forms happening at present times.

Literature Review

The word 'vernacular' has originated from the Latin word "Vernaculus", which means local, native (Gupta, Jameel and Padhy, 2020). Oliver (1997) defines vernacular Architecture when he says "All forms of vernacular architecture are built to meet specific needs, accommodating the values, economies and ways of life of the cultures that produce them". Thappa, Sharma and Kumar (2022) establish the fact that vernacular architecture fulfills several aspects of sustainability like environmental sustainability, social sustainability and economic sustainability, irrespective of their context, taking examples of Bhonga houses of the Kutch region, Gujarat, Dhajji-Dewari and Taq system of Kashmir valley and vernacular houses of Harran, Turkey. It seems to be a design challenge at the present times to take out the advantages of vernacular houses and integrate them with the contemporary typologies, which can create modern houses with sustainable features. As Hazarika *et al.* (2022) point out, through their study in the Jammu region, the vernacular style residences provide more thermal comfort than

the contemporary built-forms. Vernacular style has multiple dimensions, thermal comfort, reduction in energy consumption, socio-cultural values etc. Jagatramka, Kumar and Pipralia, (2020) formulate sustainability indicators for vernacular architecture in the Indian context, considering three pillars of sustainability. It is observed that the nature of these aspects varies in vernacular dwellings of different regions of the country. There is a need to establish such indicators to evaluate the sustainability of vernacular houses at the present time, which may result in stopping the forced transformation of vernacular styles of the regions. Jagatramka, Kumar and Pipralia (2021b) have categorized the type of transformations observed in vernacular architecture in three ways: Normative transformation with minimum or no transformation, Partial or Hybrid transformation with major changes but maintaining the essence of style and a total transformation with change in all architectural features due to global influences.

Changes are unavoidable and people adapt to them while constructing their houses. However, balance is required between maintaining the indigenous features and change due to global or local influences. Sometimes, a total transformation leads towards the complete loss of identity of the place and sometimes non-contextual design appears due to such transformations. Sadhu and Srikonda (2020) say that the transformed built-form may appear like the vernacular houses though new materials and construction methods are used and even they may appear as an entirely new typology. The reasons behind such transformation can vary with respect to the context and as per the needs of the dwellers. As Sharma *et al.* elaborate (2022), there is a need to monitor such transformations. Indeed, built-forms and effective guidelines can be formed to retain the unique character and the essence of the vernacular style in places.

Vernacular may not even be restricted to individual buildings, but can be extended towards the streets, public places, community spaces and the settlements as a whole (Bharadwaj and Kumari, 2021). Further, Sara, (2003) rightly explains the various issues that vernacular architecture face at the present times like saving the essence of vernacular from modern styles, less adaptability towards new built-forms, materials and techniques in vernacular, less acceptance towards the hybrid character of the vernacular style. It is observed that several attempts have been taken to study existing typology / morphology of vernacular houses / settlements in the country and across the world, which also covers the nature of transformation that has happened. However, very few have attempted to formulate guidelines to restrict such transformation of vernacular houses.

Research Methodology

This research is based on both primary and secondary data sources. The study takes a qualitative approach using case study method. From the literature review, the study develops a primary understanding on Kath-Khuni vernacular style of architecture. The field study is conducted into two parts, taking the Jana Village, Naggar in Kullu district of Himachal Pradesh as the area of study:

1) A rigorous field visit is undertaken for three cases, selected for study to establish several positive aspects of Kath-Khuni style for the sustainable development in Himachal. Three different building typologies have been taken to establish the same, which is done through an observational survey.
2) A questionnaire survey has been conducted among 100 dwellers of the village to get their perspective on Kath-Khuni style and its contemporary challenges. This primary survey has been done through interviews and by recording the answers in google forms.

On the basis of the case study and questionnaire survey, the final conclusion is drawn regarding to what extent Kath-Khuni can be used at present time and for what kind of building typology and where a balance is required to accept the change too.

The Background of Himalayan Vernacular Architecture (Kath-Khuni Style)

As Shankar (2013) mentions "The Himalayas as a region, both in its physical and imagery terms, forms a very important part of the narration of cultural myths in the Indian subcontinent". The simple modest houses, using stone, timber and mud as materials are called Kath-Khuni in Himachal Pradesh. Kath-Khuni structures were popular in the region as these are environment friendly, maintain the thermal comfort during harsh winters and able to withstand earthquakes duo to its high tensile strength (Kristal, 2011). 'Kath-Khuni', the word has two parts: 'Kath' means 'wood' and 'Khuni' means 'corner'. Amidst vast terrain of Himachal, the houses of Kangra and Spiti regions are made of mud and stone, Kath-Khuni houses originated from the middle Himalayan range, which covers Kullu, Manali, Chamba, Shimla and also have spread to certain zones of Uttarakhand (Handa, 2010). As explained by Thakkar and Morrison (2008), in terms of structure, Kath-Khuni is different from conventional construction techniques. Vertical columns are replaced here by horizontal beams. 'Criss-cross' bracings are used to erect such timer structure. The wooden joineries are present to hold the structure. The layer of the stone comes in-between wooden layers, which provides stability, where the timber beams are laid to allow flexibility. The roofs are covered by slate tiles.

During the earthquakes, Kath-Khuni structures may shake and generate cracks, but there is little possibility of them to collapse entirely (Dave, Thakkar and Shah, 2013). The biggest advantage of Kath-Khuni houses is that it can withstand earthquakes. During harsh winters in Himachal, the houses made of brick and concrete are not able to provide optimum thermal comfort and as a result, heating arrangements are required. In contrast, Kath-Khuni construction is able to provide thermal insulation. Its thick walls are able to retain heat and free movement of air is possible through mud plaster (Thakkar, Dave and Shah, 2012).

Such indigenous styles of building construction is slowly vanishing in Himachal Pradesh, especially from the urban and peri-urban areas under the thrust of urbanization in the Himalayan region since the last decade. Easy availability of cheap alternative materials like concrete has made this to accelerate. The transformation in vernacular style of the Himalayan region as a whole is required to be understood deeply, so that the thin line between the scale of change and continuity can be identified (Shankar, 2006).

Fig. 1: Various parts of Kath-Khuni house
Source: Thakkar, Dave and Shah, 2012

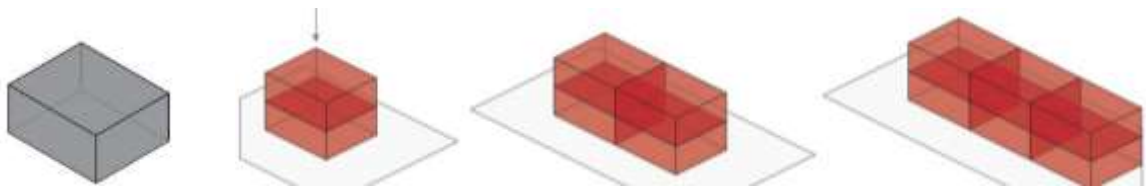

Fig. 2: Spatial organization of Kath-Khuni house
Source: Dave, Thakkar and Shah, 2013

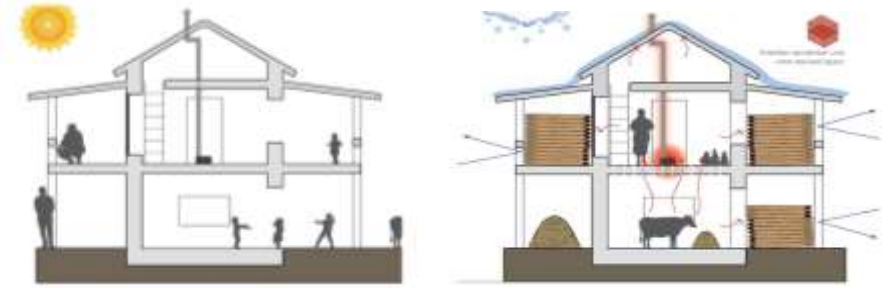

Fig. 3: House activities during summer (left) and during winter (right)
Source: Dave, Thakkar and Shah, 2013

Typical Characteristics of Built-form made in Kath-Khuni Style

As Potdar, Namrata and Sami (2017) say, Kath-Khuni can be called as 'Cator and Cribbage' or 'timber laced masonry', which displays construction through layers of wood and stone. The timber layer (frame) is repeated with increasing height, where a layer of stone is placed in-between. They can be featured as double layers of horizontal timber beams, making the thick load bearing walls. The walls are then inter-connected by dovetail joints, which is called 'maanwi's'. Vertically, between the timber beams, dry-stone masonry is provided (as shown in Fig. 4). At the corners, the beams are connected through dowels, which is called 'kadils' (Zanden, 2018). The style follows a modular system while arranging the spaces, where one module is a cuboid, which is been repeated in a linear fashion and stacked one over another as per the household size and need (Warsi and Sandhu, no date).

Study Area: Jana Village, Naggar, Kullu District, Himachal Pradesh

Himachal Pradesh, located in the northern part of India is very different from the plains of the Shivalik range, where the altitude varies from 350 meters to above 6000 meters in the North. Besides, the climate is predominantly harsh cold and the state lies in the critical seismic zone. Because of the varying altitude and micro-climate zones, the vegetation also varies across the region. A unique development pattern has evolved with respect to landform, climate, and ecology. This study particularly focuses on the Jana Village in Naggar, which 13 k.m. far from Kullu. The village is an adobe of 174 households and has around 884 people.

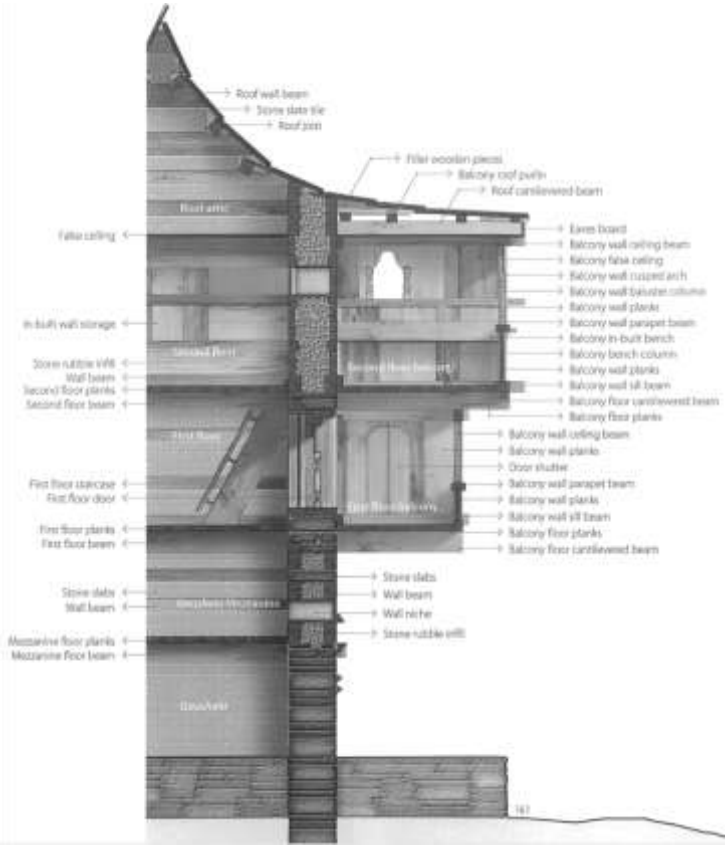

Fig. 4: Detailed section of a typical 2-storied Kath-Khuni house
Source: Dave, Thakkar and Shah, 2013

Fig. 5: Naggar in Kullu, Himachal Pradesh
Source: Author

The Discussion

The study includes rigorous field visits to understand different building typologies in the Jana Village, Naggar of Kullu District. Three case studies have been selected to map the spaces and architectural characteristics. One is a residential building, second is a temple, which has been redesigned and reconstructed in recent times and the third one is a contemporary homestay for the tourists.

Case Study 1 – Kath-Khuni House of Jana Village:

The houses of the village are built by the dwellers, sometimes with the assistance of other dwellers from the same or nearby village. The knowledge of constructing homes is passed down from generation to generation, primarily through oral and empirical traditions, by working as an apprentice for several years. The Himachal mistris are skilled at working with wood and stone and they have inherent knowledge about those crafts. The primary building materials are timber and stone for the walls and the plinth with slate shingles on top of the roof. Cedrus Deodara (Deodar / Devidar) is the main source of timber, which is native to the Western Himalayas and one of the toughest Indian conifers. It can reach a height of 50 meters and has straight veins. It is employed in all types of structural work due to its high durability.

The residence is a typical Himachal house two stories tall. The construction begins with ground preparation. A trench is dug in relation to the height of the structure, which was then filled with loose stone blocks that rise to form the plinth. The elevated podium provides stability to the house while also protecting it from the snow and rainwater. A double-skin wall is constructed made of alternate courses of drystone masonry and wood without the use of any cementing mortar. It entails laying two longitudinally parallel wooden beams with a gap between them. As a filler, a loose in-fill material is packed, and the external and internal parts of the walls are held together by cross bracings or dovetails, known as ‘maanvi’. This layered wood and stone construction is most visible at the wall corner and is a dominant feature of the Kath-khuni houses across the village, visited. As the walls rise higher, the stone courses become narrow and the wood sections expand.

At the higher levels, the heavier stone bases support the lighter wooden structure. For internal walls, the surface is typically plastered with mud. The cantilevered balcony, which projects on one side of the structure and is supported by wooden beams is fixed to the wood-and-stone walls. It is the space for spill-over activities, and an integral part of the house. The structure is topped by a wooden roof frame covered with locally available slate tiles. Walls secure the balcony's basic framework; details like parapets, fascia boards, and panels are added later. Balconies used to be open, but with time, various forms of enclosures have been observed. The supporting wooden posts, which are often molded and richly carved, also sustain the roof structure. Dave and Thakkar (2011) point out that “the balcony, which serves as an important extension to the living room, is the most important feature of the house”. The roof is in the final stage of construction and is supported by the wooden beams, purlins, and rafters, with significant overhanging protected with slate stone. The roof geometry is typically gable, but there are several variations observed across the village. The installation of the ridge beam marks the completion of the roof.

Spatially, the house is linear, a composition of three cuboid spaces stacked together with two levels of height. It is the living space for the family as well as shelter for the livestock. The houses have projected balconies on one side (southern side mostly). The balcony is one of the most significant spaces in the residence due to its dual purposes to provide thermal comfort during harsh winter and to provide spaces for social interaction and household activities during the summer. During the winter, the balconies act as storage for firewood and grass for the cattle, which provides another layer of wind protection and thermal insulation. Further, the curvilinear gable or pent-and-gable roof allows some amount of snow to settle on the roof acting as the insulation during the harsh winters. In the warm sunny days, the social interaction and household activities take place outside the house on balconies and plinths. A series of trap doors and vents in the roof allow the air circulation to take place keeping the interior environment fresh.

Fig. 6: Documentation of a residence in Jana, Naggar
Source: Author

Case Study 2 – Jeevnarayan Temple of Jana Village:

The religious structures like temples in Himachal are built by specialized artisans and craftsmen. Since the locals of the Jana Village revere the Jeevnarayan God, they consult him before beginning any new construction projects or making any significant decisions. Any religious building's entrance doors have a low lintel level so that one can bow his head in front of God before entering the holy sanctum. The old structure was not so tall. Due to its deteriorating condition and weathering of materials, it was necessary to reconstruct it, which was done in 2019 by the native craftsmen and villagers. Spatially, the older construction was linear with less height, whereas the new construction appears with taller temple typology of upper regions of Himachal. The ground floor is used for gatherings on various occasions and festivals, while the upper floor has the deity, where the balcony is used as a circumbulatory path.

The stone plinth is raised about 1 meter to keep the temple a little higher than the other structures, saving it from snow and rainwater. At the ground floor level, a typical cuboidal plan is made to maintain simplicity and make the structure more resilient to earthquakes. The first floor is being constructed on the same plan as the ground floor with wooden floor done on the wooden planks. The projected balcony is constructed only at the top floor because of the location of deity, as deity is only placed on the topmost floor. The temple is a classic example of tower typology with gable and pent roof combined. As Kath-Khuni-style temples have very fine and detailed carvings, the main entrance door in this temple proves the same. Not only on the doors but also on the balconies of this temple, the wood carving is done only by the local carpenters of the area as they are masters in all kinds of traditional carving techniques with all kinds of stories depicted in it. In this temple, the wooden carving on the balcony depicts the various “Avtar's of Lord Vishnu”. There are wooden supporting members which support the load of the balcony as well as the people walking on it. The carvings are done on these too.

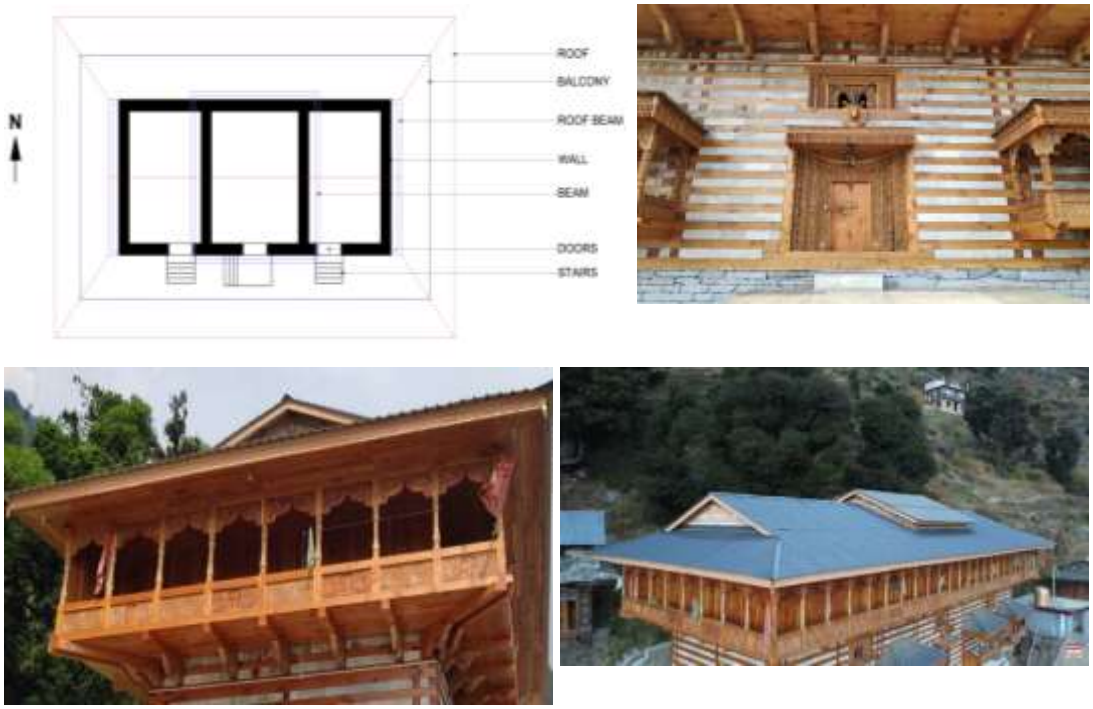

Fig. 7: Documentation of the village temple in Jana, Naggar
Source: Author

Case Study 3 – Jana Trails Chalet, A Contemporary Homestay in Jana Village:

This is a homestay, designed by Rahul Bhushan of NORTH (architectural firm) recently. The process of design and construction is an attempt to promote the age-old Kath-Khuni style of architecture. There was an existing Kath-Khuni house within the site itself, which was abandoned. It is observed that the advantage of kath-Khuni house has the potential to dismantle and reuse materials. In this case, around 40-45 % materials have been re-used. A very high plinth and retaining walls are being constructed to make the chalet less prone to landslide. Spatial arrangement is kept same as seen in the typical Kath-Khuni houses, where the ground floor has a lesser footprint and the first floor has projected balconies. The chalet has balconies at its front and back sides to provide views of the mountain and the dense forest around it. More space has been given in balconies for tourists to sit, relax and enjoy the natural views. The combination of pent and gable is maintained for the roof. There are no wood carvings in the design. However, the structure has wooden brackets to support the balconies, wooden frames for windows and glass panels to enhance clear outside views.

Fig. 8:
Documentation of Jana Trails Chalet in Naggar
Source: Author

Comparative Analysis between Case Studies:

A comparative analysis has been done to understand the differences and the similarities between the different types visited, as shown in Table 1 below.

Table 1: Comparative Analysis among Case Studies
Source: Author

Parameter	**Kath-Khuni House**	**Jeevnarayan Temple**	**Jana Trails Chalet**
Orientation	North-South	North-South	South-West
Wall Thickness	450 - 500mm	450 - 500mm	450mm
Openings (Material)	Wood Panels 	Wood Panels 	Glass Windows 

Carvings	No wooden carving present	Wooden carving on doors, balconies and other wooden part exists 	No wooden carving exists
Projections	Used as storage in winters and for recreational, social, household purposes in summers 	Used as circumbulatory path 	Used as outdoor seating space 
Materials	Wood, stone and slate 	Polished wood, dressed stone and GI sheets 	Polished wood, dressed stone and slate 
Roof	Gable roof 	Combined pent and gable roof 	Combined pent and gable roof 

Findings from the Questionnaire Survey

A questionnaire survey was administered among the dwellers of the village on related aspects like reasons behind the preference for the RCC structure and their perceptions about Kath-Khuni vernacular architectural aspects. The questionnaire used a 5-point Likert scale. The survey was helpful to identify the thrust areas, where the future enhancement is required. The survey reveals significant aspects such as the following.

1) Only 30% of the village houses are of pure Kath-Khuni style in terms of their spatial arrangement, materials and construction techniques. Out of the rest of the 70% of the houses, 40% have completely changed by adopting RCC construction and 30% have changed partially. The dwellers have used RCC in making foundation, walls, slabs etc. and maintain the roof structure and appearance as in typical Kath-Khuni style.

2) It is evident from the survey that the availability of raw materials like stone and wood and their high cost is the main reason behind this shift from the vernacular to the modern style. In spite of the remoteness of the village, it loses its indigenous character.
3) Due to rapid urbanization and expansion of infrastructure like highways and roads, it has become easy to access materials for the RCC construction at a cheaper rate. Thus, people have started to move to cement and brick building over the traditional style.
4) Even when employing RCC construction, the village dwellers still prefer to articulate the facades with arched windows, projected balconies, high plinths, combined pent and gobble roofs which are true characteristics of the Kath-Khuni style.
5) Duo to the changes in the social fabric, lifestyle and occupations of the people, even in villages, the preferences for the RCC structure has risen in recent times and it has become a matter of social status.
6) Around 80% of the village dwellers, who were surveyed has supported the RCC construction as it is difficult to get craftsmen to build Kath-Khuni houses these days. If available, then it is with higher cost, while it is easier to get cheap labor to construct RCC houses.
7) The survey has also revealed wall thickness as an aspect behind this shift from vernacular to contemporary building construction method. In Kath-Khuni, the wall thickness ranges from 18-25 inches, whereas in RCC and brick walls, the wall is 9 inches thick. Thus, there is a saving of carpet area as well as cost.
8) It is also observed that among the dwellers who were surveyed, around 70% have changed their house layouts from typical Kath-Khuni linear cuboid arrangement to other forms like C/L/U shape arrangement of spaces as per their needs and convenience.
9) Around 90% of the village dwellers, who responded to the questionnaire has supported the construction and restoration of temples in Kath-Khuni style because of their belief in cultural roots and rituals.

Conclusions

A transition period has been observed in the remote village Jana of Naggar, in terms of the architectural vocabulary. This study has taken three prominent cases – an old residential building, a village temple reconstructed and a resort / homestay of contemporary times. They all use the indigenous Kath-Khuni features and have followed the construction method. From the detailed study and analysis of these three cases, it is clear that Kath-Khuni style, though losing its popularity among the dwellers, should be supported because of the following reasons:

1) **Energy Efficiency:** The spatial arrangement of a typical Kath-Khuni house provides thermal comfort at its best, which cannot be provided in any other way. The cuboidal stacking of houses along contours captures the maximum sunlight. Because the materials (wood, stone, and mud) are sourced locally, there are no transportation emissions. Because materials do not deteriorate over time, they could be re-used for future constructions. To avoid waste from the site, the remaining waste from the work site is used in masonry infill and there is almost zero waste. Hence, this style truly responds towards energy efficiency and sustainability, which is the need of the hour.
2) **Local Materials:** Wood and stone were obtained originally from the immediate surroundings of the building plot. These materials are both environmentally safe and durable. Metal is used in very limited ways.
3) **Low Maintenance:** Maintaining and repairing requires very little effort. The locals can replace or repair pieces of stones by themselves. Because the material is from the same region, it can withstand the weather, leading to low maintenance.
4) **Structural Resilience:** Non-rigid construction assists in the dissipation of stress during the earthquake, providing seismic resilience. The wooden structure serves as a tensile framework, and the stone walls support the compression load. The heavy roof, with its timber and slate framework acts as a balancer. The cracks can't mitigate through the

whole wall due to the rubble stone masonry. Similar shifts and movements can also be accommodated by the slates on roofs pivoted to the wooden frames. The doors and windows are much smaller and lesser, which allow for even and quick load transfer while minimizing the effect of movement during an earthquake.

5) **Design Efficiencies:** The design of the houses is based on simple geometry and modular stacking blocks for spatial organization. The balconies act as a spill-over spaces for various day to day activities. Because of its geometrical stacking, it is more stable in earthquakes.

Besides these three cases, the village dwellers were surveyed to understand their perception on Kath-Khuni, reasons behind the shift and various contemporary issues and challenges in maintaining this vernacular style of architecture. The findings from the questionnaire survey are quite similar with the on-ground observations during field visits. After reviewing the positive aspects of this style and analyzing people's responses, the followings are recommended to overcome such transition and to revive Kath-Khuni Architecture for an environmentally sustainable Himachal.

1) **The government buildings** in the region are reconstructed using RCC method, where in some cases, they apply some features of Kath-Khuni for façade articulation and aesthetics, like metal carvings, arched windows, projected balconies, slate roof etc. Stone cladding is also used to appear like Kath-Khuni. However, the application of such outer layers doesn't work towards sustainability. Thus, it is recommended to reconstruct the government buildings – socio-cultural, administrative, institutional or any other types in Kath-Khuni style, which may create an image and identity for the entire region and could also foster awareness among the citizens on this architectural style. This may even be included at a policy level guideline for government construction.
2) **For all religious structures,** like temples whether new or re-construction, adopting Kath-Khuni can be mandatory through Development Control Regulations of cities. Similar to Heritage zone regulations, guidelines should be developed for applying the vernacular style to such structures as a part of DCRs. Such attempts can bring a homogeneity in style and appearance across the region.
3) **Tourism** is an intrinsic part of Himachal and the occupation and income of its people. Tourism industry can play a vital role in promoting Kath-Khuni style of architecture. Detailed guidelines can be produced for Tourism building types to follow Kath-Khuni, at least in a hybrid nature. Guidelines related to minimum wall thicknesses, materials to be used for foundations, walls and slabs etc., the presence of high plinth, combined pent and gobble roof covered with slates, projected balconies can be part of the building bye-laws to showcase the indigenous style of the state and maintain the character in future.
4) **For the residential buildings:** There is a need to find a balance between Kath-Khuni and RCC construction. An alternative to stone and timber is required to find, so that Kath-Khuni can regain popularity among the common people. Lot of research takes place on this aspect, where Kath-Khuni can be more flexible and adaptable towards the new techniques. Bamboo, which is cheap and fast-growing has the potential to replace the wood in Kath-Khuni style of construction. Even the cost and time required to construct the Kath-Khuni houses using the old techniques and materials can be reduced by replacing wood with other sustainable and cheap materials like bamboo, hempcrete, stabilized earthen blocks, lime concrete etc.

The study concludes that through a change in policy level and by formulating detailed guidelines for new or reconstruction, the sustainable, environment-friendly Kath-Khuni style of architecture together with contemporary construction technique can be revived in Himachal and the true essence of this style can be maintained.

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