

A study of vernacular architecture and indigenous construction techniques of the Kullu Region, Himachal Pradesh

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Abstract: The architecture of a place depends on the climate, geography, resource availability, material and knowledge of construction techniques, geography, building rules and regulations, socio-economic conditions, household characteristics, culture, infrastructure availability, and other natural forces. The hilly regions remain less connected to outside regions, both in physical and information linkages. The exchange of materials and information about the construction techniques has endangered the usage of indigenous material and construction techniques for the development of climate-responsive architecture. The authors thoroughly investigated the local materials and contemporary construction techniques of the Kullu region, Himachal Pradesh. Vernacular buildings constructed by using indigenous materials and construction techniques are more responsive to their geo-climatic conditions. The lessons of traditional wisdom in building construction can be a very powerful tool for sustainable development. The paper concludes with the plausible policy required for the preservation of indigenous construction techniques for sustainable development.

Keywords: Vernacular Architecture; Indigenous Construction Techniques; Hilly Region; Sustainable Development.

Note: This paper is a revised and expanded version of a paper entitled 'study of vernacular architecture and indigenous construction techniques of the Kullu Region, Himachal Pradesh' presented at International Conference on Advances in Construction Materials and Structures (ACMS-2018) organised by Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, India [March 7-8, 2018].

1 Introduction

The architecture of a place is the outcome of the climate, geography, resource availability, material and knowledge of construction techniques, geography, building rules and regulations, socio-economic conditions, household characteristics, culture, infrastructure availability, and other natural forces. Indigenous architectural solutions, based on local needs, locally available construction materials, and reflecting local traditions, have responded well to these natural forces. The information exchange due to globalization has impacted all spheres of human life, including the built environment. Hill architecture remained pristine due to low infrastructure connectivity making the material transfer difficult in hilly terrain. Hilly people remain dependent on the tourism economy. The increased invasion of hills by population from plains has forced a change in indigenous architectural style due to various factors i.e., climate change, economy, material supply from another region, etc. (Fig. 1).

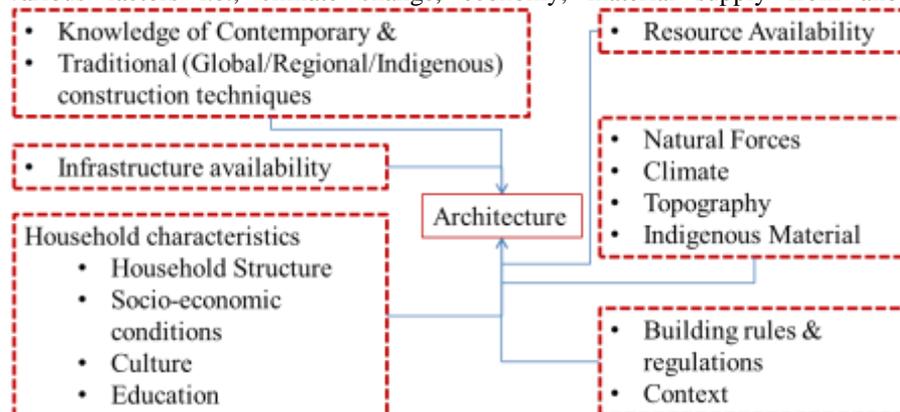


Figure 1: Factors affecting the architecture of a place

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The infiltration of architectural plan formulations, materials, and construction techniques has led to a change in the architectural character of the region. The use of vernacular architecture and indigenous construction techniques is on a sharp decline in hilly regions (Sarkar, 2013) (Rahul & Ahuja, 2014). The study region is well known for its Dhajji wall, Kath-Kuni construction technique, slate as a roofing material, plan formulations. This architectural character, with its ethnic, regional, and local 'dialects, is disappearing in hilly regions (Negi, Jain, & Singh, 2017). The change in architectural character will lead to loss of identity of the Kullu region, which will have a backwash effect on the tourism industry in the long run as tourists are attracted by the architecture and climate of the region. Himachal Pradesh is one of India's most tourist-attractive states (Tiwari, 2017). The construction technique and architecture may seem a very small factor but is of paramount importance. The authors have analyzed the need for indigenous architecture for the development of the Kullu region.

2 Brief Profile of Kullu Region

Kullu region, Himachal Pradesh, has been selected to study vernacular architecture and indigenous construction techniques of hill settlement. The Kullu district has a spread of 5,503 km² and is located in Himachal Pradesh, India, approximately at 4000 feet altitude, 31.957851, and 77.109459 latitude and longitude coordinates respectively (Fig. 2). Kullu is the capital town of the Kullu district and is located at Beas River. It is famous for a broad open Kullu valley between Manali and Largi. The settlements are small villages named, Bhilyani, Soyul, Lag valley in district Kullu. The main seasons and temperature variations found in these regions are Summer from March till June (Max. temp 33.8°C, Min. temp 14 °C), Winter from December to February (Max. Temperature 16°C, Min. Temperature 2°C) and Monsoon from July to September. During the winter months, the temperature goes down to the freezing point, even heavy to medium snowfall occurs. Therefore, the cold climatic conditions are predominant here, which is also supported by the climate classification of India by the National Building Code of India. A pleasant climate is found during the autumn season of October and November.



Figure 2: Location map of Kullu district, Himachal Pradesh, India (Govt. of HP, n.d.).

3 Methodology

The authors are well versed in the region and its architectural character. A Survey technique has been used in this research. A total of 185 surveys were conducted, out of which 23 have been discarded due to lack of knowledge about the architecture of the Kullu region. The physical survey is used to identify the most common architectural characteristics and indigenous construction techniques. The reasons for the decline in the use of vernacular architecture and indigenous construction techniques have been identified, and views of residents (users, masons, and material suppliers) of the region on the revitalization of vernacular architecture and indigenous construction

techniques have been gained through a survey questionnaire. The methodology adopted for the entire study has been presented in Fig. 3.

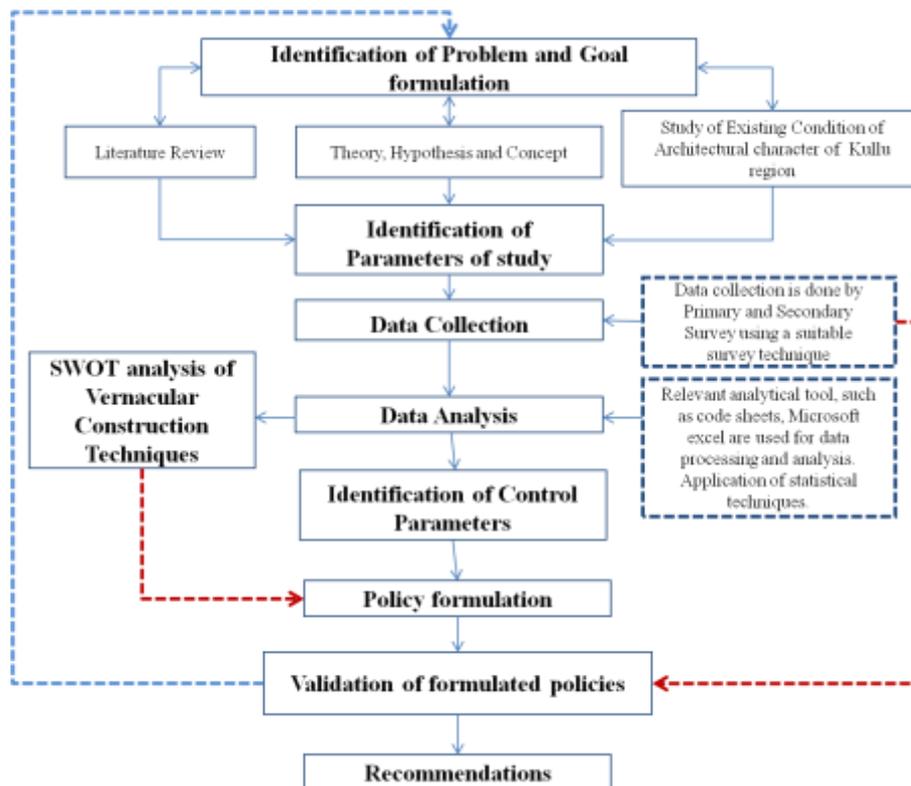


Fig. 3: Methodology adopted in the present investigation.

4 RESULTS AND DISCUSSION

4.1 Physical survey of the Kullu region

4.1.1 The architectural character of the study region

Despite the infusion of foreign materials and construction techniques, the architecture in the Kullu region is primarily characterized by local materials, integrating socio-cultural and economic fabric, but the pace of change is fast. The buildings are an example of sustainable architecture. The majority of houses in the region have passive architecture features used for controlling temperature and ventilation. Based on the controlling parameters, functional plans have evolved over a period of time. The spaces are the outcome of the natural factors, local materials, socio-cultural and economic factors, e.g., the kitchen is preferably kept in internal core of the building to keep the surrounding spaces little warm, ground floor is generally used for livestock and fodder storage which exposed the habitable spaces on the first floor to heat generated from the livestock (Sharma Sandeep, Sarkar Amitava, 2011) (Fig. 4.)

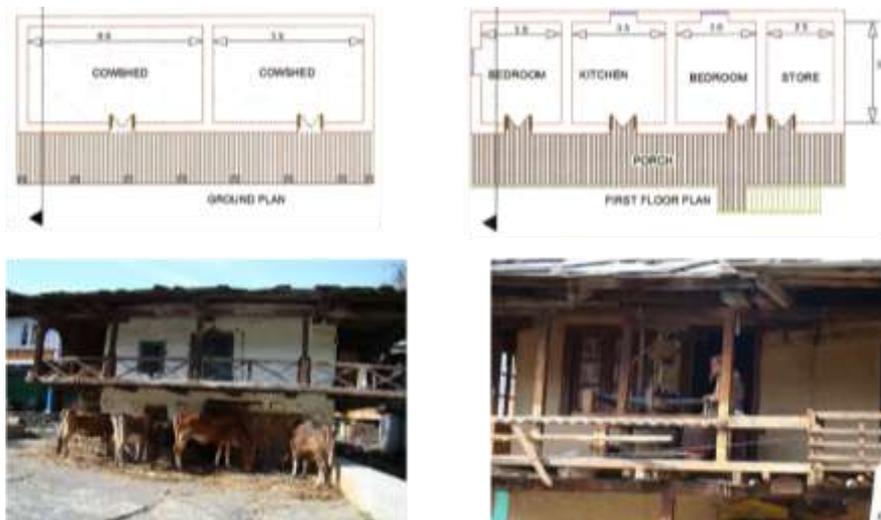


Figure 3: Functional plan of a building (a) Ground Floor (b) First Floor (c) Cattles on Ground Floor & (d) habitable rooms on the first floor with Sunspaces (Verandah) - for yarnning by using “khaddi”

Low volume spaces used to provide thermal comfort at less energy consumption. Glass covered balconies and verandas are there, which act as sunspace during the day, basically solarium type of arrangement with double skin type arrangement to trap heat for space. These spaces are used as sunspaces and for yarnning by using “khaddi” in most of the houses. These balconies are also used as storage space for fodder; this fodder provides time lag to heat loss as well as acts as an insulating surface and increases the thermal mass (Fig. 5). Lofts are constructed under the pitched roof, which is used as storage space and provides thermal insulation and thermal mass.

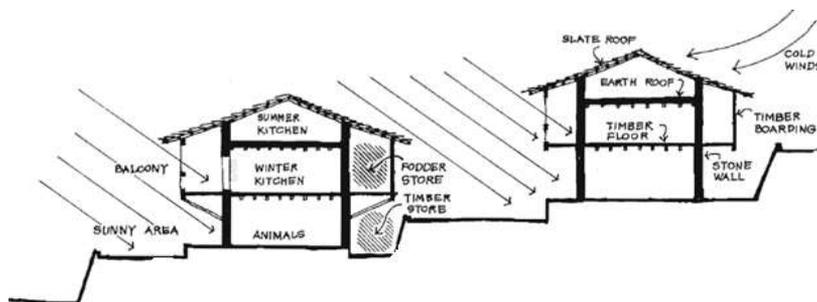


Figure 5: A typical section of a House at Kullu

4.1.2 Indigenous construction techniques

Indigenous construction techniques used in the study area, e.g., the practice of using plaster on the inner surface and avoiding it on the outer surface, adds to thermal comfort by increasing the conduction of solar radiation from outside to inside but provide thermal resistance in loss of heat back to the environment (Fig. 6a). Dhajji (A. Kumar & Pushplata, 2013; Sharma & Sharma, 2013) construction provides earthquake resistance (Fig. 6b). The uses of local materials reduce the cost of transportation and are cheaper in comparison to materials procured from outside the region. The locally available labour is efficient in handling the local materials and construction techniques, e.g., Kath-Kuni (A. Kumar & Pushplata, 2013; Sharma & Sharma, 2013) technique (Fig. 6c and 6d) (Francis D.K. Ching, 2008); so, employment opportunities can be retained to local people.

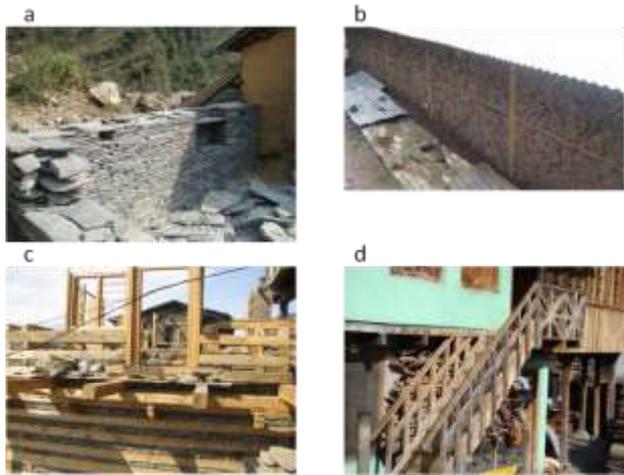


Figure 6: (a) Dry Stone Construction (b) Dhajji-Dewari Construction (c) Kath-Kunni Construction (d) Wooden Construction

The mixed construction and use of foreign materials and construction techniques have not only changed the architectural vocabulary of the region (Fig. 7a) but also changed the visual sustainability of the region (Fig. 7b).

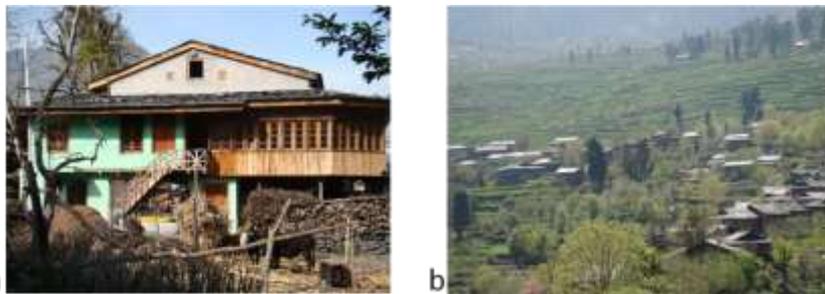


Figure 7: (a) Changing architectural fabric and (b) existing natural settings

4.2 Results and discussion

Total 185 surveys were conducted at six different locations, out of which 23 have been discarded due to lack of knowledge of respondents about the architecture of the Kullu region. Tourists, the general public, masons, and building material suppliers have been considered as different stakeholders in the survey. The analysis of the survey pointed out that from 39 tourists only 31, from 104 general public only 95, from 23 masons only 17 and from 19 building suppliers, all 19 were aware of the architecture of the Kullu region (Fig. 8). So, the total number of respondents who were aware of the architecture of the Kullu region, i.e., 162, were considered for further analysis of the survey.

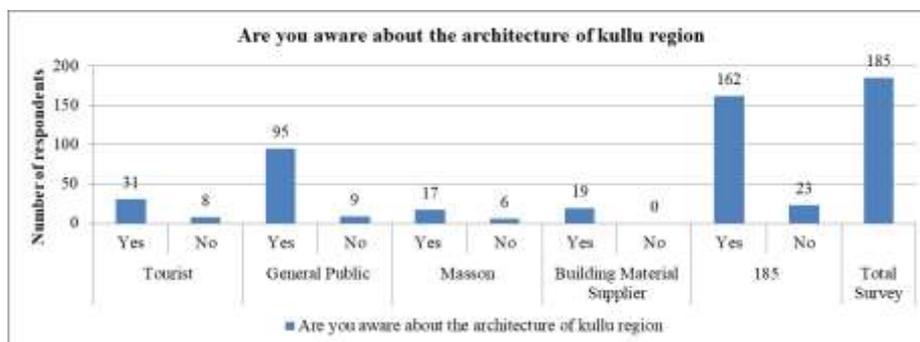


Figure 8: Awareness about the architecture of the Kullu region

The analysis of a question about awareness about change pointed out that a higher share of participants from all stakeholder groups was aware of the change (Fig 9). Furthermore, maximum respondents were aware of the change in architectural style as it is the visual character of the built environment (Fig. 10).

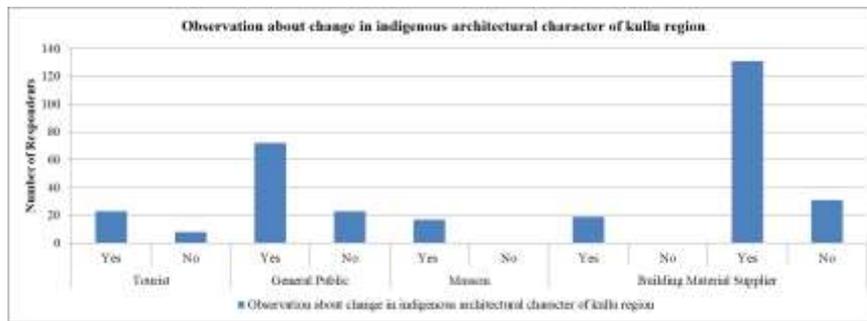


Figure 9: Observation about change in indigenous architectural character of the Kullu region

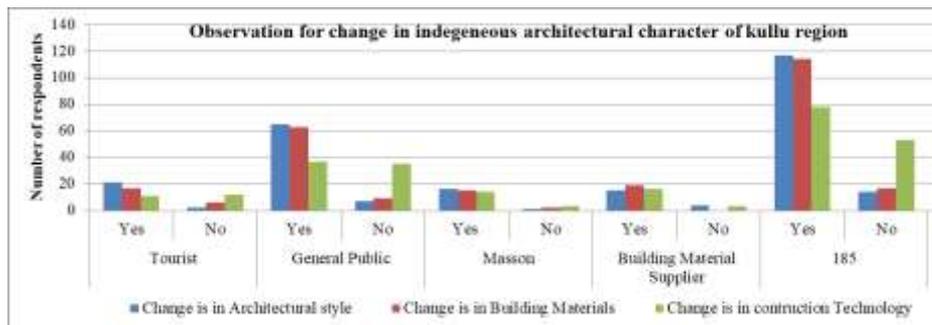


Figure 4: Observation for change in indigenous architectural character of the Kullu region

The majority of stakeholders are aware of the cause of change in architectural character and construction techniques (Fig. 11). The scarcity of local materials has been identified as the main cause of change by all. Also, it is observed that tourists were among the least aware group, as most of them were first-time visitors in the Kullu region. As perceived by authors, the awareness about new architectural styles has not been identified as an important cause for change by the general public.

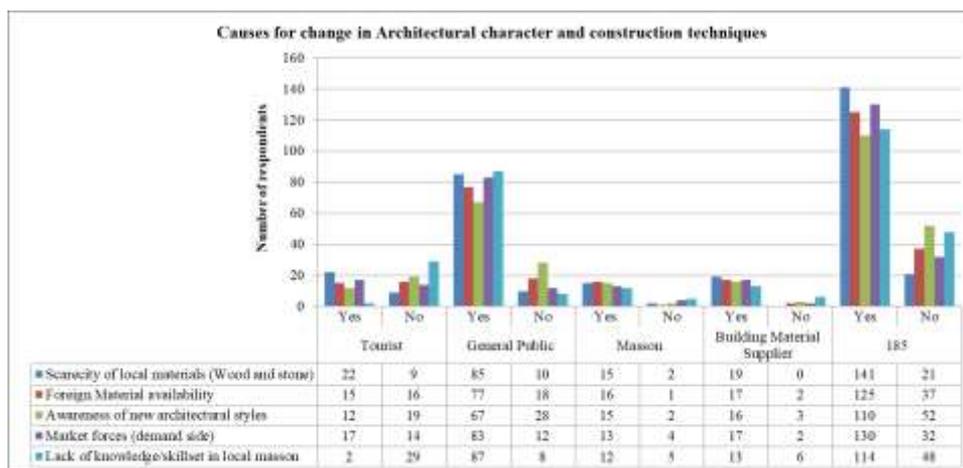


Figure 5: Causes for change in Architectural character and construction techniques.

Majority of stakeholders, excluding the tourists, are aware of architectural functional plan layout and building elements (Fig. 12). The technical terms like solarium were least identified building element, this was due to the use of the technical term in the survey.

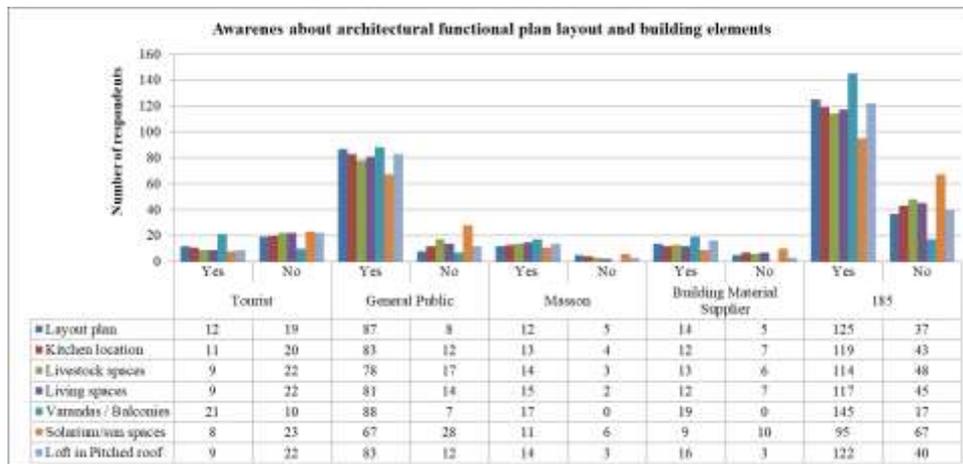


Figure 6: Awareness of architectural functional plan layout and building elements

The results of the question on knowledge about the indigenous construction techniques and materials are presented in Fig. 13. Although, tourists were not aware of the local construction techniques, yet they were aware of the materials. All the tourists were highly enthusiastic about knowing the material as they were fascinated by the use of indigenous construction techniques application on local materials. The proportion of stakeholders from other groups on knowledge about indigenous construction techniques and materials is also low.

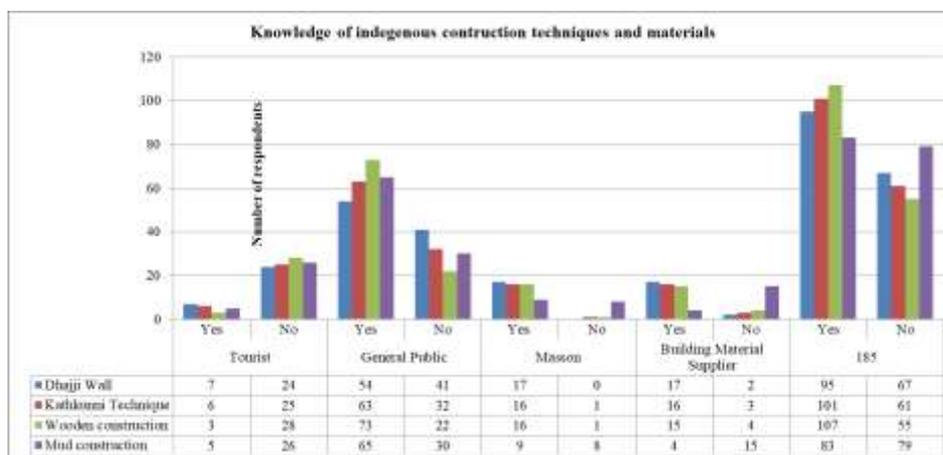


Figure 13: Knowledge of indigenous construction techniques and materials

All the stakeholders are of the view that the thermal comfort in buildings with vernacular architecture constructed by using indigenous techniques and materials is high as compared to contemporary buildings (Fig. 14). Masons have a mixed view on this question, which could be used as a parameter for increasing knowledge in the same field of all other stakeholders by proper training and awareness.

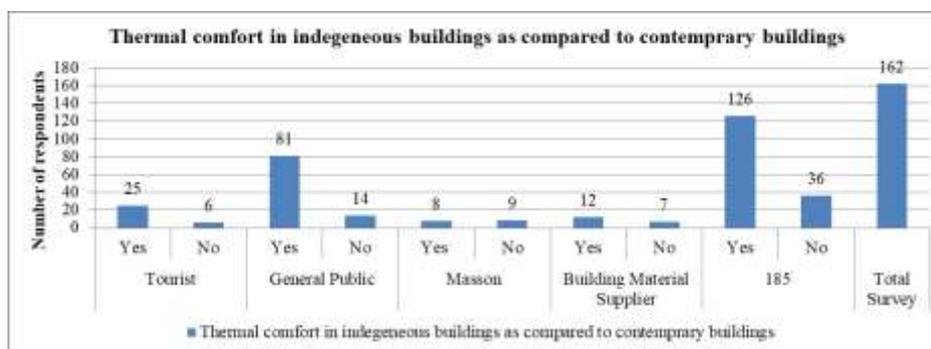


Figure 14: Thermal comfort in indigenous buildings as compared to contemporary buildings

Majority of stakeholder are of the view that conservation of vernacular architecture, indigenous construction techniques and materials is good for the sustainable development of Kullu region (Fig. 15). All the stakeholders

were aware of employment opportunities and social-cultural (Ahluwalia, 1998) development along-with the environmental benefits of using vernacular architecture and indigenous construction techniques and materials.

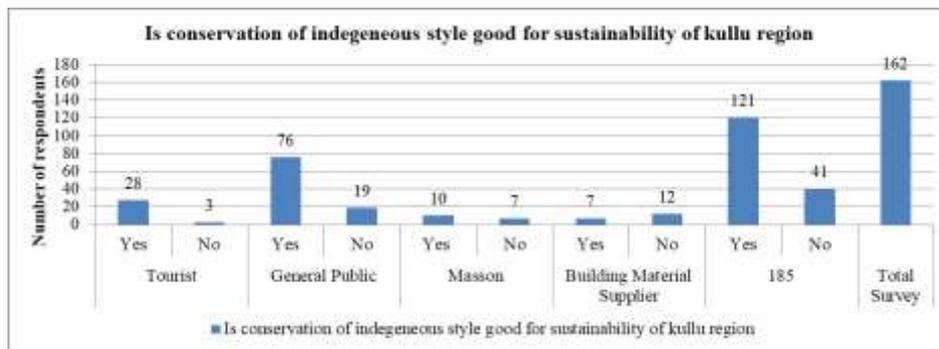


Figure 15: Importance of conservation of indigenous style good for the sustainability of Kullu region

Public opinion on policy adoption for the revitalization of usage of vernacular architecture, indigenous construction techniques and materials are presented in Fig. 16. The survey pointed out that public awareness about different policies on the revitalisation of usage of vernacular architecture, indigenous construction techniques and materials is very less. Majority in all stakeholders have an opinion that large-scale tree plantation and promoting the availability of materials can revitalise the usage of vernacular architecture, indigenous construction techniques, and materials. The setting of BMTPC research and development has not been identified as a major policy due to lack of knowledge about the works of BMTPC. But the authors are of the view that the setting of BMTPC R&D centre would yield good results.

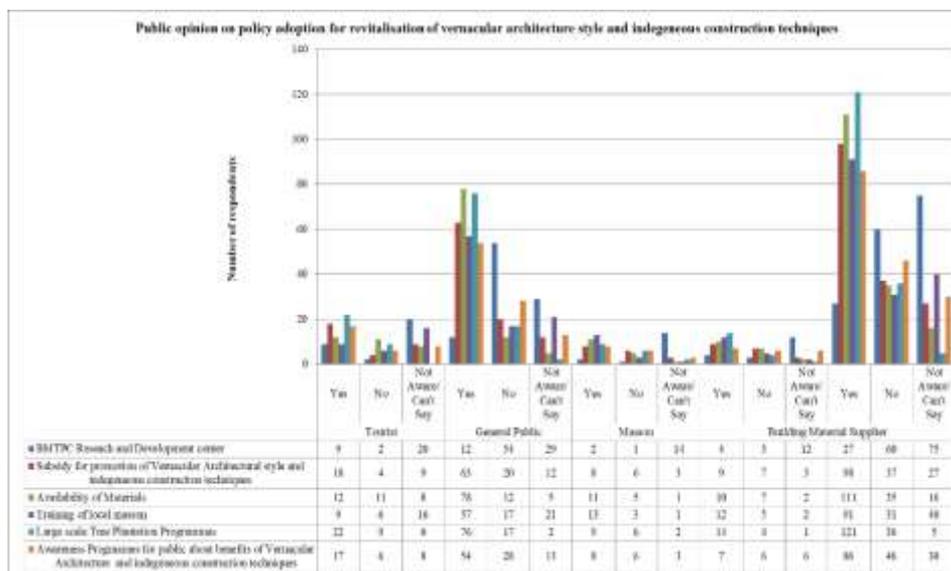


Fig. 16: Public opinion on policy adoption for the revitalisation of Vernacular Architecture style and indigenous construction techniques

The study conducted reveals that traditional architecture has a strong relationship between the form of architecture and the local climate (Gadi, Soma, & Mishra, 2019). On the other hand, the traditional construction techniques and materials were evolved as a response to local climate and availability of materials. But with the advancement in the field of technology and the availability of new materials in the market, the people have started using these materials in construction, which are not suitable for the respective climate. Also, there is a shortage of traditional materials, stones/slates, wood, etc. The skilled labours who were experts on those traditional construction techniques are not available these days. Hence, people are also adopting newer materials for their building construction, which are not responsive to the climate. Vernacular architecture in combination with indigenous construction techniques will yield sustainable economic, social, environmental, and cultural development. The inference is that Himachal Pradesh's Vernacular architecture is the product of its traditional climatic conditions, landscapes, raw material availability, and other natural sources (T. A. Kumar, Kumar, & Arshad, n.d.).

4.3 Recommendations

Based on the thorough literature review and analysis of the state of vernacular architecture and indigenous construction techniques in the study area, i.e., Kullu Region, Himachal Pradesh following recommendations are made for the conservation of nature of architecture and indigenous construction techniques in the hilly region:

- i. Native tree plantation and safety programmes should be a regular part of state policy for the regular supply of wood.
- ii. Awareness programmes should be run for describing the benefits of sustainable development, vernacular architecture, and indigenous construction techniques to locals as well as tourists.
- iii. The government should focus on the development of skill development centers focusing on the development and showcasing the vernacular architecture and indigenous construction techniques.
- iv. Incentives should be given in the form of property taxes and on the bills for tourists to promote the conservation of the architectural character and indigenous construction techniques.

5 Conclusion

Traditional construction techniques and materials were evolved as a response to local climate and materials availability. Market forces require faster construction with state of the art facilities, and indigenous techniques are unable to cope with the situation. The choice of material used in different areas is dependent on its availability and structural properties. The shortage of material has led to shifting to new materials, especially wood. Thermal comfort in building in vernacular architecture and indigenous construction techniques is high as compared to contemporary architecture, and vernacular architecture is more climate-responsive and ecologically sensitive. Policies on the revitalization of usage of vernacular architecture, indigenous construction techniques, and materials are need of time.

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