Habitat Solutions for Uttarakhand

Eco-Friendly Multi-Hazard Resistant Construction Technologies for Habitat

Under TIME-LEARN Programe of DST

सत्यमेव जयते
Government of India
Department of Science & Technology
Ministry of Science & Technology

Partners

Development Alternatives

HESCO
Himalayan Environmental Studies and Conservation

Context

Department of Science and Technology, Government of India, has undertaken an initiative for Technology Intervention for Mountain Ecosystem: Livelihood Enhancement through Action Research & Networking (TIME-LEARN Programme).

Focus of this programme is Technology Innovation in 3 States i.e. Jammu and Kashmir, Himachal Pradesh and Uttarakhand. Currently the program has 20 projects working under 5 thrust areas. as:

- Sustainable Agriculture & Bio-farming
- Forest use and biodiversity
- Rural engineering and technology support services
- Water resource management
- Disaster management and landslide control

Under the thrust area, Development Alternatives along with its implementation partner HESCO Dehradun has undertaken initiative to enable large scale dissemination of affordable, eco-friendly and multi-hazard resistant construction technologies and water solutions, in response to specific challenges of Uttarakhand.

About

Multi- hazard prone mountain states like Uttarakhand are seeing intensive construction activity, leading to high resource and energy consumption pattern in these regions. Thus, there is an evident demand for new and adaptive research and development to explore alternative building materials based on local resources and also for skill up gradation of the masons practicing in this disaster-prone region

Objectives

Process Development: To assess traditional construction materials and technologies and identify how they can be improved upon and adapted to meet challenges faced by the current construction scenario

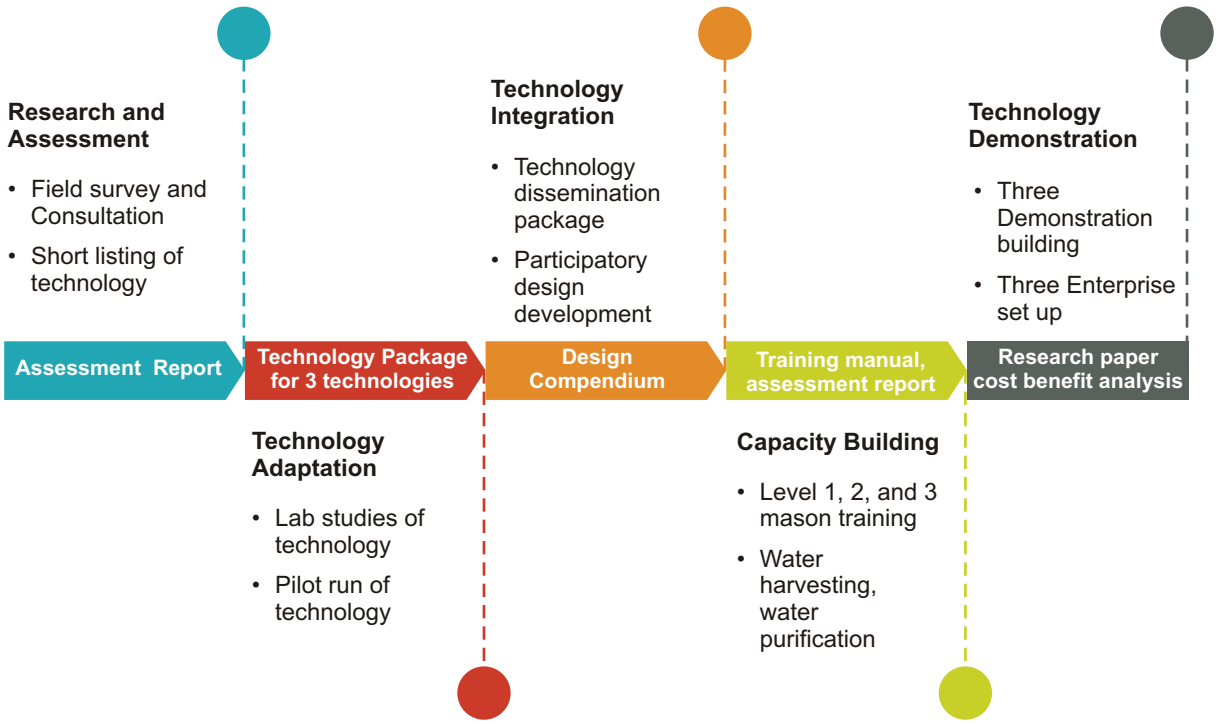
Process Adaptation: To customize identified building and water technologies such that they can be practiced / produced in 'enterprise' mode at a decentralized level and be made available to remote and difficult terrains

Technology Package: To prepare the templates of appropriate design options for rural houses and community buildings and anganwadi

Technology Capability Development: To build capacities of masons through trainings and demonstration buildings and selected building material enterprise packages to enable availability of materials on ground

Scientific Knowledge Generation: To develop a scientific evidence base for the solutions recommended through tools such as cost-benefit analysis, carbon and resource efficiencies, thermal comfort and safety and contribution to local economies

Methodology



New and Adapted Technologies

Stabilized Compressed Earth Blocks (SCEB)

Made from a mix of earth and a small % of cement/lime, compressed in a press and cured

- Uniformly shaped
- Good compressive strength
- Can be produced at village level using local soil
- Economical solution to expensive clay bricks
- Negligible carbon footprint

Concrete Blocks

Made from a cement, stand and aggregate, compacted in a machine and cured

- Simple Production technique
- Already being produced in the village-but of poor quality
- Economical solution to expensive clay bricks

Stone Filler Block

Made from a mix of lean concrete and stone pieces and/or waste filler stone, manually compacted and cured

- Simple production technique, variation of concrete block
- Economical solution for areas where stone is available
- Exposed stone on the face gives aesthetic appearance - no plaster required

Micro Concrete Roofing tile (MCR)

A concrete roofing tile of 9.5" x 19.5" size, made with fine aggregate

- High durability-transverse load strength of min. 80 kg
- Can be produced locally in micro- enterprise mode
- Durable alternative to CGI sheets
- Tied to understructure-good resistance to lift-off in high winds

Precast Plank and Joist roof

Precast RCC slabs placed on precast RCC beams to construct intermediate roof slab

- Pre-casting saves construction time
- Can be produced using steel/wooden moulds by a micro enterprise
- Saves cost by reduction in steel and shuttering

Wood shingles

Thin tapered pieces of timber laid over battens of wooden sheating

- Technology developed and tested by FRI-can be downscaled for micro-enterprise level production
- A good alternative for a light-weight roof
- Introduces timber treatment and engineering in construction scenario

Technology Selection Criteria

The criteria for assessment of the technology solution is based on very clear parameters as Non-negotioable and Negotiable are :

Non-Negotiable:

Hazard Resistance: To ensure structural integrity of buildings

In order to integrate structural resilience in building against natural hazards, it is necessary to build capacity of artisans in hazard resistant practices. This is important because Uttarakhand lies in IVth and Vth Seismic zone of India and is subjected to frequent earthquakes and floods leading to loss of life and infrastructure.

Decentralised Availability: To localised production of building technology and ensure replicability

Since most of the building materials used in traditional construction are sources locally in natural ecosystem, and thus was already localised. Now, In current scenario high dependency on cement and steel is seen in thus the local production become nodes of building materials.

Environment Impact: To integrate resource efficiency in production and construction systems of building

In modern construction systems, high energy and emissions are seen on account of usage of cement and steel thus transportation of materials and rampant sand mining. In order to minimize the harmful impact efficient and engineered use of natural materials in both production and construction system need to be integrated.

Negotiable:

Cost: To access the building materials and technologies at affordable range

Maintenance: To sustain durability of building technology and its easy replicability

Thermal Comfort: To ensure appropriate response to climate

Cultural Response: To integrate with traditional design and skills

Expected Project Benefit

People Participation

- 1014 households involved in technology generation
- 4 Self Help Groups of 70 members engaged
- Rural Population of 3988 individuals reached
- 935 individuals reached of SC population
- 90 individuals mobilized for skill training in building technologies
- 83 individuals consulted in participatory design planning

Technology Dissemination

- 3 technology packages 3 production units
- 25,350 individuals
- 3 production unit for identified technologies
- 3 technology package
- 3 research papers
- 3 buildings demonstrated

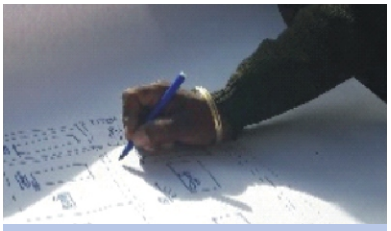
Livelihood Enhancement

- 60 workers trained
- 30 workers trained on new technology
- Increase in employment
- Increase in productivity
- Increase in income
- Increase in net profit of the enterprise

Tools and Techniques

Following are the different tools and techniques are used during the course of the project to for research and development, development of technology and house and community building designs and to transfer the technologies to local artisan group.

Documentation and Survey



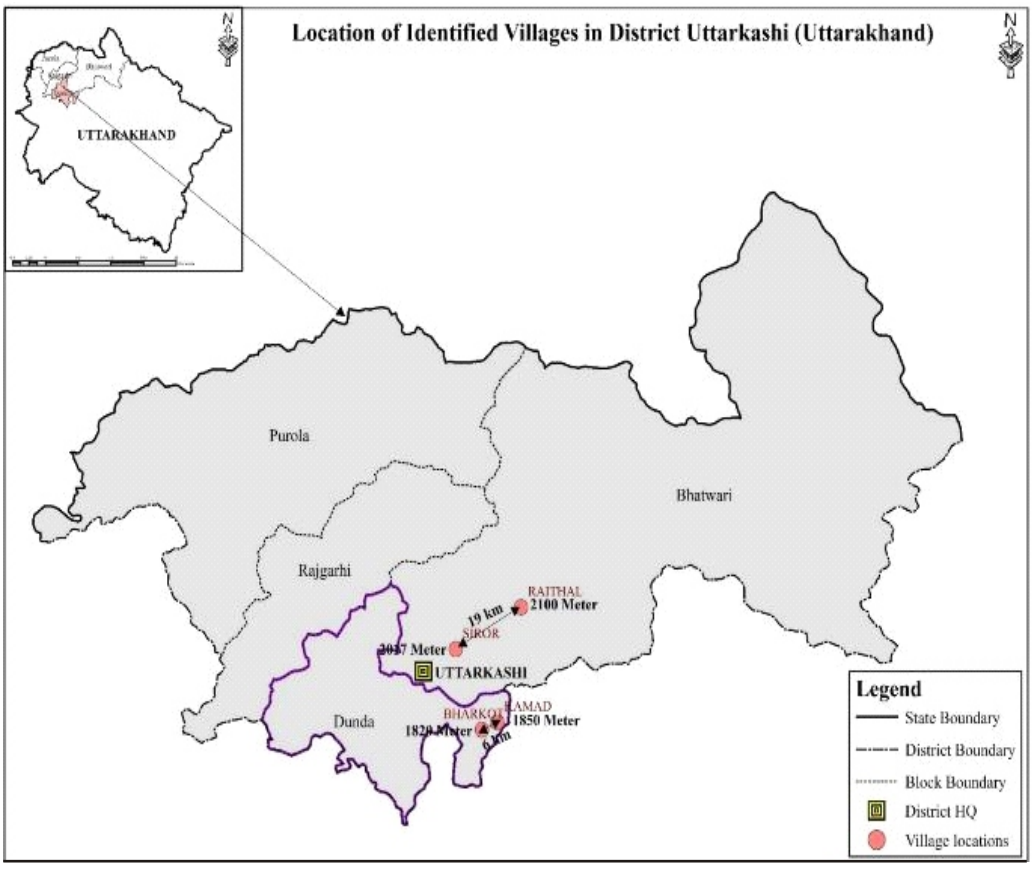
Participatory Design Exercise

Capacity Building

Location Map

Selection Criteria of Villages

- Not extreme out migrations (inhabited villages)
- Accessible in terms of mobility
- Reliable supply of electricity and water
- Availability/ Sourcing of raw materials
- Visibility (market, govt.)
- Land availability for implementation of demo building
- Logistical challenges for survey
- Recptiveness of local government
- New construction/ vs retrofitting
- New and traditional practices



DST

Department of Science and Technology (DST) was established in May 1971, with the objective of promoting new areas of Science & Technology and to play the role of a nodal department for organising, coordinating and promoting Science and Technology activities in the country. The Department of Science and Technology plays a pivotal role in promotion of science and technology in the country.

HESCO

HESCO is an NGO that derives inspiration from the villages and devises solutions for their problems. It helps them to focus on their economic and development needs and encourages them to tap local resources that open up new avenues to self- reliance. HESCO has been applying knowledge of the environmental sciences and simple technologies to bring consistent development to the rural villages of the Himalayas. Their innovative and ecologically-sound solutions so far, have yielded outstanding results in their target regions.

Development Alternatives

Development Alternatives (DA) is a premier social enterprise with a global presence in the fields of green economic development, social empowerment and environmental management. It is credited with numerous innovations in clean technology and delivery systems that help create sustainable livelihoods in the developing world. DA **focuses** on **empowering communities** through *strengthening people's institutions and facilitating their access to basic needs*; **enabling economic opportunities** through *skill development for green jobs and enterprise creation*; and **promoting low carbon pathways for development** through *natural resource management models and clean technology solutions*.

Development Alternatives

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