



Government of Nepal
National Reconstruction Authority



IDRC | CRDI

International Development Research Centre
Centre de recherches pour le développement international

ICIMOD

Building Resilient Mountain Communities: Earthquake reconstruction in Dhungentar

IDRC Project Number: 108231-001

Dhungentar, Nuwakot, Nepal

International Centre for Integrated Mountain Development (ICIMOD)

Final Technical Report

December 2018



Acronyms

CEO	: Chief Executive Officer
CSR	: Corporate Social Responsibility
CSSB	: Compressed Stabilized Soil Block
DEM	: Digital Elevation Model
DUDBC	: Department of Urban Development & Building Construction
GIS	: Geographic Information System
GoN	: Government of Nepal
ICIMOD	: International Centre for Integrated Mountain Development
IDRC	: International Development Research Centre
MoU	: Memorandum of Understanding
NGO	: Non-Governmental Organisation
NPR	: Nepalese Rupees
NRA	: National Reconstruction Authority
RCC	: Reinforced Cement Concrete
RMV	: Resilient Mountain Village
VDC	: Village Development Committee

Foreword



The NRA is highly pleased with its partnership with ICIMOD and IDRC on this earthquake reconstruction and rehabilitation project in Dhungentar, Nuwakot. Following the catastrophic 2015 earthquake in Nepal, the NRA has been committed to helping people in all affected regions rebuild and recover. We have been implementing and assessing reconstruction of disaster-resilient infrastructure by optimally utilising local labour, resources, and international assistance. The NRA signed a memorandum of understanding with ICIMOD to extend full cooperation in this pilot demonstration project aimed at rebuilding disaster-resilient houses for a vulnerable community. To facilitate low-cost housing construction, we approved the disaster-resilient interlocking compressed stabilised soil block (CSSB) technology. This technology has been a widely used alternative in disaster-affected regions in Nepal and around the world, and its use in Dhungentar demonstrates how innovative, alternative solutions can be tailored for mountain villages. The transformation in the village beyond reconstruction has been remarkable, and the project's accomplishments go in line with the NRA's aim of establishing secure and prosperous communities in Nepal.

Sushil Gyewali,
CEO, NRA



I am very pleased that ICIMOD's pilot demonstration project in Dhungentar has been successfully concluded after over two years of resolute effort. We wanted this project to extend beyond post-disaster reconstruction towards strengthening the village in a holistic manner. I am happy to see that the community has taken huge strides towards greater security and improved livelihoods. The project's integrated approach was based on the concept of resilient mountain villages, which was developed at ICIMOD to address challenges and opportunities specific to mountain communities. The project addressed a wide range of critical development areas to build the foundation for a self-sufficient village, and the locals showed remarkable willingness to embrace and contribute to the project's vision. Today, the village has admirably rebounded from the earthquake to become adaptable and resilient. The project's integrated approach has great potential for replication in regions across the Hindu Kush Himalaya. I would like to congratulate all collaborators, our dedicated ICIMOD team, and the Dhungentar people on the successful implementation of this project.

David Molden,
Director General, ICIMOD



I am delighted that the earthquake reconstruction and rehabilitation project in Dhungentar has been successfully concluded. We began with a vision of creating a model mountain village with adequate infrastructure, proper access to basic services, and livelihood opportunities. We wanted to develop the local capacity so that the village could withstand future shocks, and we sought to ensure that this development was sustainable and replicable. I am pleased to see that we have come a long way and stayed the course. IDRC has been supporting research and development in Nepal since 1972 and has also had a longstanding partnership with ICIMOD. The Dhungentar project is a great example of our approach in Nepal: We have secured livelihoods, mobilised the locals, introduced innovative technologies, and created opportunities. Our experiences with this project will help share knowledge of integrated post-disaster rebuilding and rehabilitation in other regions. This is significant.

Anindya Chatterjee,
Regional Director – Asia, IDRC



It is heartening to witness the transformation of Dhungentar village after reconstruction. The change from dejected to smiling faces in the before and after photos speaks volumes of this transformation. It was a fulfilling experience overcoming challenges and realising what we envisioned for Dhungentar: a pilot reconstruction project focused on not only rebuilding shelters but also uplifting livelihoods by involving many different actors, including the private sector. Being a part of this project has been a rewarding experience, especially winning the hearts and minds of the marginalized community and making a small difference in their lives. I hope the opportunities that we have created will go a long way in rebuilding the community and I will be happy if locals will now find opportunities in Battar and not Qatar. I am sure that the overall experience of reconstruction and rehabilitation can be replicated in other parts of Nepal and the Hindu Kush Himalayan region in a post-disaster situation.

Basanta Raj Shrestha,
Director Strategic Cooperation, ICIMOD

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Background



The catastrophic 7.8 magnitude earthquake that struck Nepal on 25 April 2015 resulted in 8,790 deaths and the destruction of 498,852 private houses, with losses estimated to be around USD 7 billion, or about a third of Nepal's GDP.

Nuwakot is one of the severely earthquake affected districts of Nepal. More than 57,900 private houses were fully damaged and almost 4200 houses were partially damaged. Many lives and properties were lost, including associated injuries, trauma and long term physical and mental health effects. There were 1,099 deaths recorded and 1051 injuries in this district. Public buildings such as schools, hospitals, health posts, government offices, and other infrastructures were heavily damaged. This shows a major setback on the human, social and economic sectors of the region.

ICIMOD, as an intergovernmental organization with a regional mandate, has been working towards sustainable and resilient mountain development through knowledge and regional cooperation in the Hindu Kush Himalayan region. ICIMOD is focusing on disaster risk reduction to improve resilience of mountain communities in partnerships with regional and international agencies.

Accordingly, in partnership with the National Reconstruction Authority (NRA) and with support from the International Development Research Centre (IDRC), ICIMOD implemented a pilot demonstration project from April 2016 to September 2018 – 'Resilient Mountain Village: A Pilot Demonstration Project on Earthquake Reconstruction and Rehabilitation in Dhungentar, Nuwakot'.

The Dungetar Settlement of Charghare VDC of Nuwakot District was chosen for the implementation of IDRC supported project titled Resilient Mountain Villages: A Pilot Demonstration Project on Earthquake Reconstruction and Rehabilitation in Dhungentar, Nuwakot". The settlement covers 96 households spread across five village clusters: Ratamate, Karamfedi, Archale, Dhand and Mathiloo Dhand.

Following a 2016 social survey by ICIMOD, the need for disaster-resilient infrastructure in Dhungentar was apparent, with houses, schools, roads, and workplaces affected. To compound



problems, the community was socioeconomically vulnerable and lacked proper support systems and social security nets to rebound from the shock. Marginalised and Dalit communities constitute an overwhelming majority of the village, and their economic insecurity is highlighted by dependence on subsistence agriculture and traditional, low-earning occupations.

With a dearth of employment opportunities and entrepreneurial possibilities given Dhungentar's inadequate infrastructure and poor market linkage, the out-migration rate among local men is high. The majority of men who do work within Dhungentar are involved in traditional skill-based occupations (masonry, blacksmithing, tailoring, carpentry, etc.) or casual off-farm labour.

The project focused on reconstruction as well as help in rebuilding the livelihoods opportunities of the earthquake affected families in a sustainable manner. The key objectives of the project are the followings:

- To develop a resilient mountain village utilizing participatory and innovative tools, technologies and approaches for effective disaster mitigation and risk management;
- To enhance capacity of local community for improved community resilience and livelihoods opportunities based on local niche and sustainability;
- To develop knowledge base for wider dissemination and showcase a pilot resilient mountain village for potential upscaling and replication for sustainable reconstruction and rehabilitation in a post disaster situation; and
- To foster partnership with relevant stakeholders and encourage private sector participation for building safe and resilient mountain villages.

DHUNGENTAR: A BRIEF PROFILE

Dhungentar settlement suffered considerable damage during the 2015 earthquake. Given the Dhungentar community's marginalised and disadvantaged status, the challenges to and need for assistance in reconstruction and rehabilitation efforts were apparent. However, possibilities for collaboration and local entrepreneurship were also evident. Hence, the pilot demonstration project focused on helping the 96 households within the project area rebuild, recover, and rebound.

SOCIOECONOMIC STATUS



96%
Dalit/marginalised
ethnic groups



Largely dependent on
subsistence agriculture and
traditional professions



NPR
127,703
Avg. annual income
(Dhungentar).

WOMEN'S STATUS



Only
around
20%
of houses owned
by women



Only
around
38%
of women over
16 years of age
earn an income

PRE-EARTHQUAKE STATUS



Only
2%
permanent
houses



11
households without
land ownership,
living as tenants

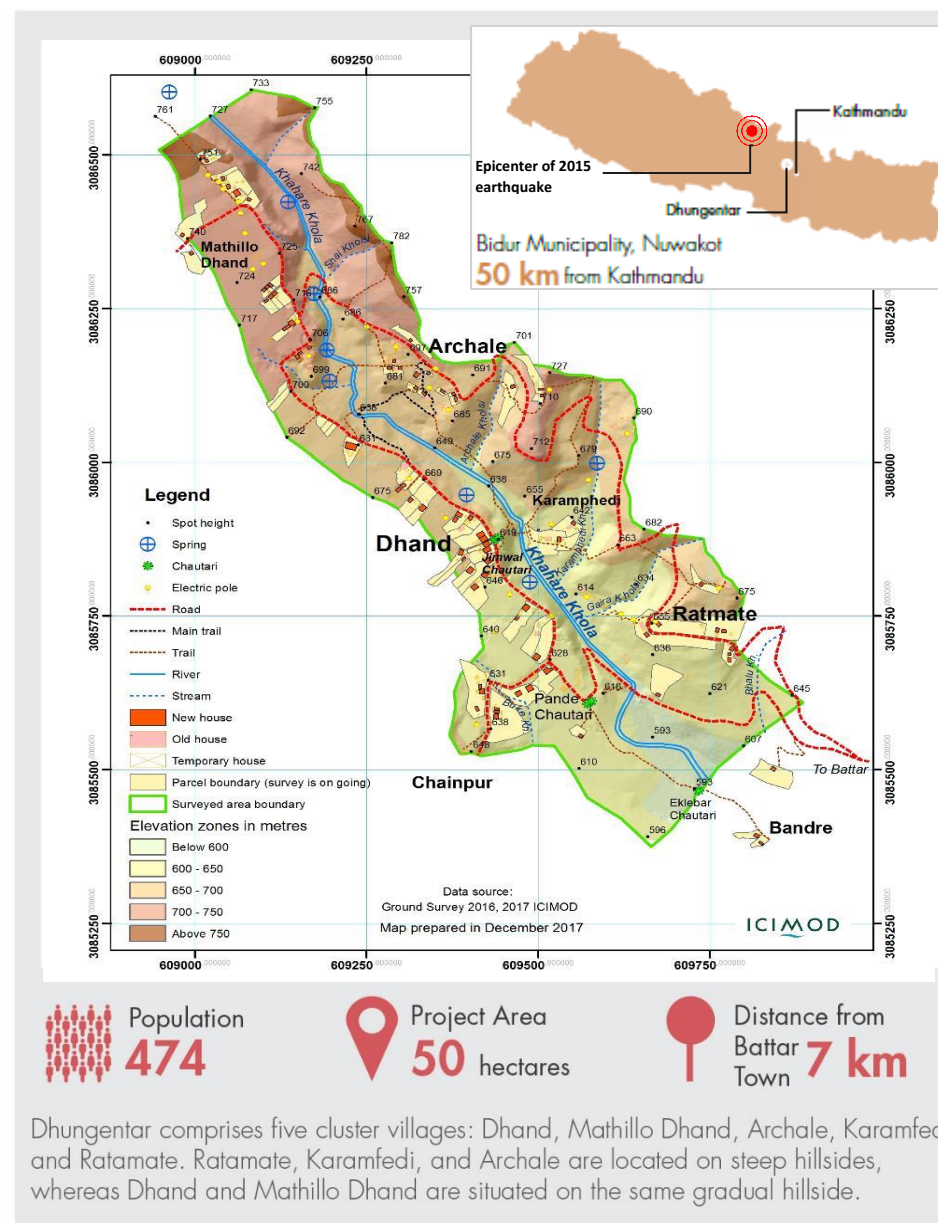
POST-EARTHQUAKE STATUS



99%
houses fully
damaged

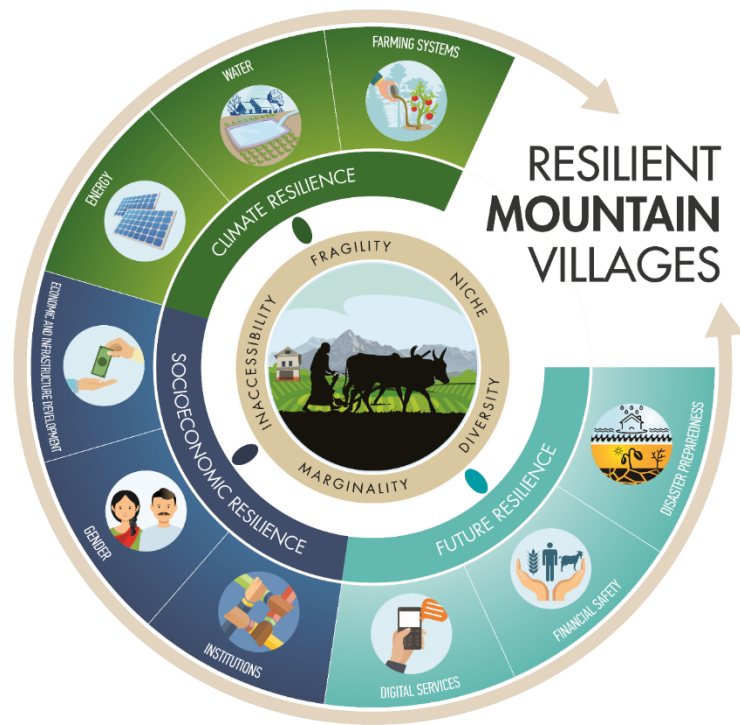


58
houses located in
landslide-prone
areas



Dhungentar comprises five cluster villages: Dhand, Mathillo Dhand, Archale, Karamfedi, and Ratamate. Ratamate, Karamfedi, and Archale are located on steep hillsides, whereas Dhand and Mathillo Dhand are situated on the same gradual hillside.

Implementation Strategy



The implementation of the project include building and restoration of housing and public infrastructure, irrigation and water management, livelihood improvements including gender issues and women empowerment, and development of an institutional framework to allow better disaster mitigation and risk management for future natural disasters through knowledge gathering, sharing and dissemination. The project focused on promoting green solutions and improving resilient livelihood options covering different thematic areas such as agriculture development, water management, renewable energy solutions, ICT based tools and technology for health/education and disaster and to promote self-sustainable local enterprises that will help generate job opportunities, including promoting public-private partnership.

The pilot demonstration project sought to create a resilient mountain village for its development activities in Dhungentar. This concept involves an integrated approach to sustainable development, encompassing economic, social, and environmental dimensions to ensure resilience and adaptation. For Dhungentar, this resilience-building process was formulated in a post-disaster reconstruction and rehabilitation context. The community's needs, strengths, and aspirations were taken into consideration when framing the project's approach. Emphasis was placed on mobilising the community and encouraging ownership in the project activities, and indigenous knowledge and practices were harmonized with innovative modern practices to ensure gradual adaptation and sustained development.

This project focused on helping Dhungentar locals rebuild, recover, and rebound in a manner that insulates them from future shocks. With socioeconomically marginalized communities comprising the majority of the project beneficiaries, the aim was to support a particularly vulnerable village through a difficult transition period and to ensure that the village builds on its strengths and grasps opportunities. The project intended to address infrastructural frailties, reduce socioeconomic vulnerabilities, and elevate the living

SDGs ADDRESSED



standards of Dhungentar locals in the long term, thereby building a resilient mountain village that is smart and adaptable to change.

A multipronged approach was necessary to address different facets of Dhungentar life. Reconstruction of houses required immediate attention, and community infrastructure also needed considerable development. The community was encouraged to participate in these reconstruction activities to allow integration into the project's vision and voice their opinions on planning and prioritization. Different programmes were organized specifically to encourage such participation.

Accordingly, ICIMOD established a strategic partnership with Nepal Reconstruction Authority (NRA) through signing on a Memorandum of Understanding (MoU) at the beginning of the project to use build-back-better principles by building disaster resilient infrastructure and improving the local livelihood opportunities for mountain communities. The collaboration gave a national recognition of the project and helped to work together with different government and other stakeholders, both at national and local levels. ICIMOD collaborated with a local NGO "Sahayata Samajik Sanstha" for the implementation of the project activities. At the community level, an eleven-member "Community Based Reconstruction Committee" was formed after several consultations with villagers for their participation and ownership on the reconstruction activities, and to meet NRA guidelines.

The project activities are divided into four core areas, or building blocks: (i) disaster-resilient infrastructure, (ii) community mobilization and capacity development, (iii) livelihoods and enterprise development, and (iv) access to services and environment improvement. These core building blocks address Dhungentar's vulnerabilities and involve activities that comprehensively strengthen the community and serve as a model for reconstruction and rehabilitation in a post-disaster situation.

Building Blocks

ICIMOD conducted a social survey, needs and baseline assessments; prepared a topographic survey of the project site and detailed design outlining both reconstruction of houses and livelihood enhancement opportunities; developed preliminary project information management system; constructed a participatory 3D Model with the participation of the villagers, carried out detailed landslide and geo-hazard assessment; and prepared geo-planning and Master Plan with detailed design and construction management plan. Similarly, detailed beneficiary information was collected, Community Based Reconstruction Committee was formed, and number of community consultations were made. All of these baseline study, community participatory approach, and collaborative design tools helped to provide ingredients for creating a blueprint for reconstruction and rehabilitation.

Disaster Resilient Infrastructure



Livelihoods and Enterprise Development



Access to Services and Environment Improvement



Community mobilization and improvement of Community

Disaster Resilient Infrastructure



ICIMOD's main emphasis in the project was on building resilient houses and infrastructure. ICIMOD applied an owner-driven mechanism providing material and technical support to 90 households, based on assistance, inspection and certification at various stages of the construction to ensure compliance with National Building Code as set by Government of Nepal. Discussions with relevant authorities and local community and experts helped to ensure that the housing and service solutions are economically, socially and culturally acceptable, and meet villagers' requirement. The houses were designed to be flexible to retrofit in the future.

The main achievement of the project is the inculcation of a culture of earthquake resistant construction in the project area. Provision of seismic provisions in the building codes on rural housing was not subjected to any building control or technical supervision, but built using prevalent methods and materials. The villagers used to construct their house without set standard but as per knowledge of local artisans.

The project adopted interlocking compressed stabilized soil blocks (CSSBs) as the technology is cost-effective, utilize local labour and materials, resilient to earthquake, and green technology. Government of Nepal approved the technology in March 2016 for the construction of disaster-resilient houses and toilets in Dhungentar.

The support modality involved assistance to beneficiaries through the following:

- Construction labour and materials equivalent to NPR 200,000 to houses using CSSB and RCC technologies, in addition to the NPR 300,000 grant distributed by the GoN in three tranches.



- For each household adopting the CSSB technology: distribution of 2,200 locally produced CSSBs and support in construction labour and materials equivalent to NPR 35,000 (excluding CSSBs) for toilet construction

However, this technology was not imposed upon the beneficiaries. While aid was provided for 54 houses using the CSSB technology, 36 houses used the reinforced cement concrete (RCC) technology, which is more prevalent throughout Nepal.

It is to highlight the geo-hazard assessment, GIS mapping, topographic survey and 5m DEM, and detailed field assessment greatly added value to planning and reconstruction effort. Initially, it was thought that Archale settlement with around 19 households and to the east of the main settlement, needed to relocate to a safer area as the settlement is located in landslide prone area. The geo-hazard assessment concluded that the area is less prone to large geo-hazard events if no major alteration of environmental and topography is done.

Along with the construction of shelters, ICIMOD improved road connectivity within and to the project by improving access road, and constructing walking trails and bridge, improved *Chautari* gathering place and installation of solar street lamps. ICIMOD believe proper road networks support the villagers to uplift their livelihood through better market linkages, and access to urban services.



“I didn’t even know how to use a shovel when I went for the block production training. They said we should learn how to make these blocks and that we would get them for free to build our houses. So I went. We were mostly women there as the men were away working. In 20 days, I slowly learned about the process and about all the materials needed. Then for around two months, we made those blocks every day. It became quite easy after a point. We made up to 500-600 blocks a day. I was one of the faster ones there. The blocks you see in my house- I probably made them! Having been involved in the process, I think they’re quite strong. But who knows how strong the next earthquake will be.”

Sunita Mijar
Rotamate

In collaboration Nabil Foundation, the project constructed a multipurpose community centre for holding community meetings and events, workshops, trainings, health-camps, cooperative and information centre. During the disaster, the Centre can act as Emergency Operation Center for distribution of relief materials, health-post, and information centre for victims. The Centre was inaugurated by CEO of National Reconstruction Authority on 17th of December 2018 amid a function. The community centre is built in an area of 6,500 sq ft (19 Anna) has a capacity to accommodate more than 100 persons.





Carbon Footprint of CSSB Technology

With the use of interlocking CSSB in place of the conventional burnt bricks, an examination was undertaken on carbon footprint of the houses, toilets and community centre and differentiate between the conventional burnt bricks and interlocking CSSB in terms of CO₂ emission.

According to findings of the examination, the total carbon emission of the 90 houses, 54 toilets and one multipurpose community building was estimated to be 959.13 tonnes of CO₂ equivalent, which is 533 tonnes of CO₂ (i.e. 35%) less than conventional burnt bricks construction.

Compressed Stabilized Soil Block Production Process

1 TESTING

- Soil from local mining areas sent to Kathmandu for tests
- Composition of clay, sand, and silt in the soil tested to determine mixture ratio



3 MIXING

- Cement: Sand: Soil = 1: 3: 5
- Water added as per need



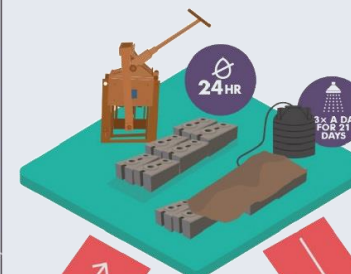
2 COLLECTION & SIEVING

- 22 unskilled locals trained, including 19 women
- Soil collected from selected local mining areas
- Clay and sand sieved to obtain fine materials



5 USE IN RECONSTRUCTION

- CSSBs used for infrastructure construction in Dhungentar

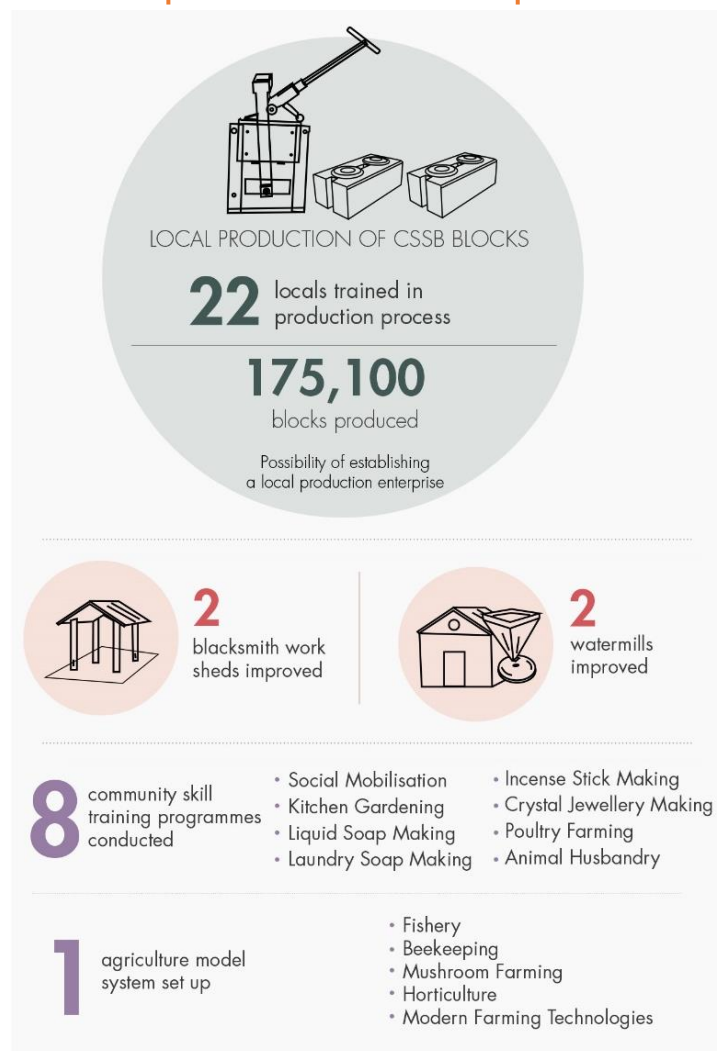


4 COMPRESSION & CURING

- Mixture compressed using 6 manually operated machines
- 24-hour dry curing and 21-day wet curing
- Prepared CSSBs randomly selected for compressive strength tests



Livelihoods and Enterprise Development



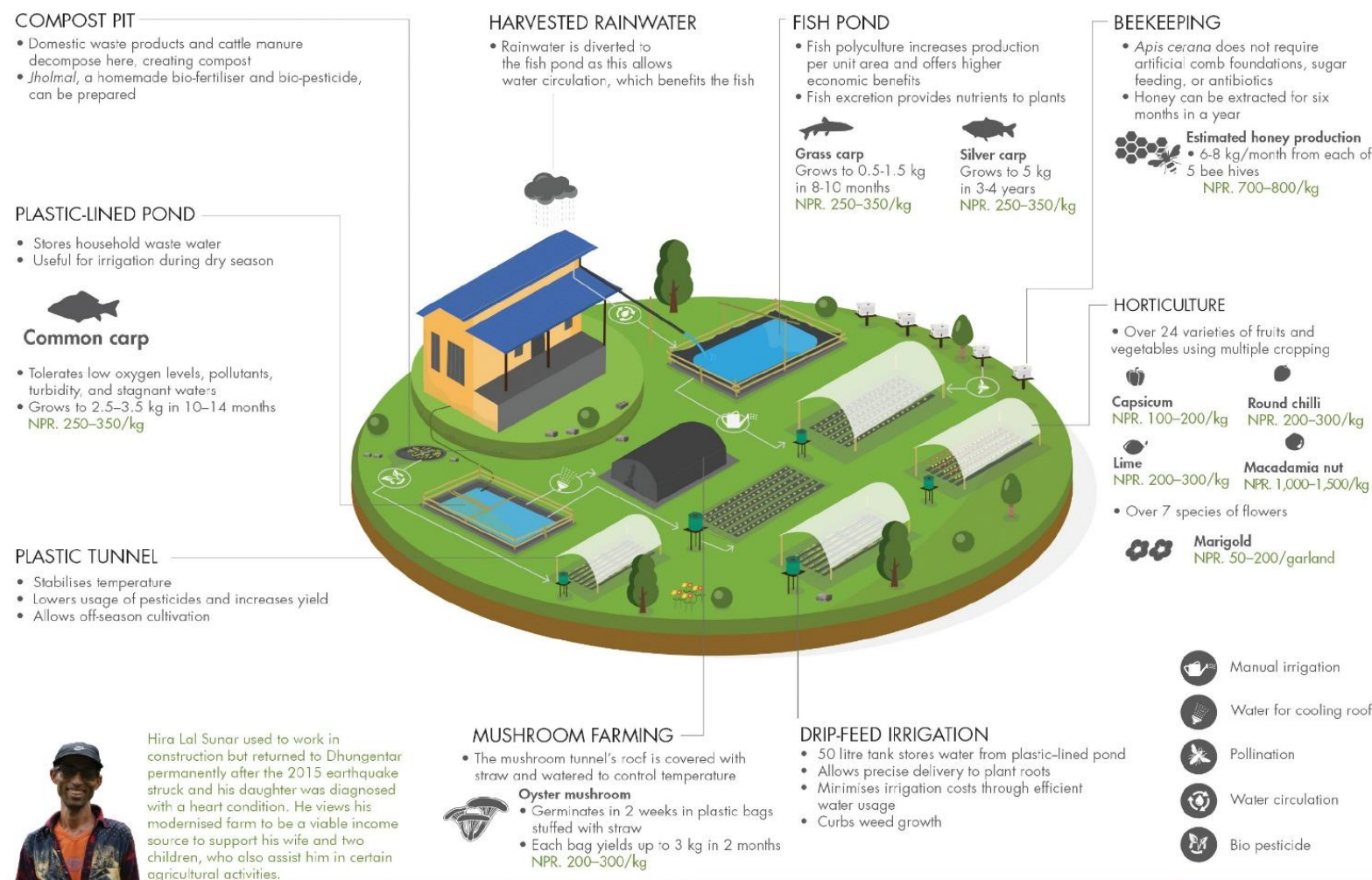
ICIMOD blended the reconstruction activities with a strategy for livelihood recovery strategy in the project area to create employment-intensive reconstruction work, develop skills of the villagers, promote enterprise development and micro-finance, increase agricultural productivity, improve farming techniques, and facilitate access to markets. Priority was given to livelihoods activities that offer short term and medium term benefits.

Initially, the project provided employment opportunities to the villagers to have immediate income by engaging them in producing CSSB blocks, reconstruction of shelters and infrastructure, and road and trail building. The project provided several training to enhance their skill for producing CSSB blocks, reconstruction work, social mobilization, kitchen gardening, vocational and other entrepreneurship activities to make their livelihoods more resilient.

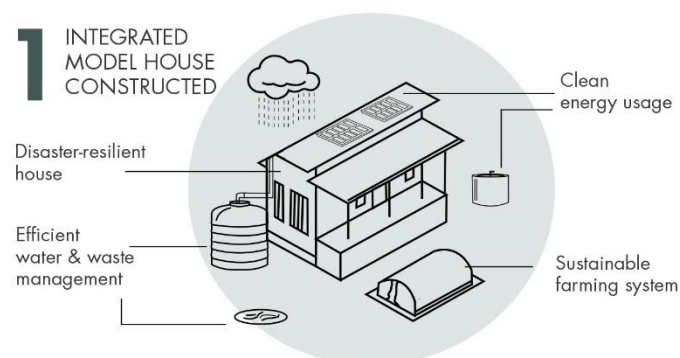
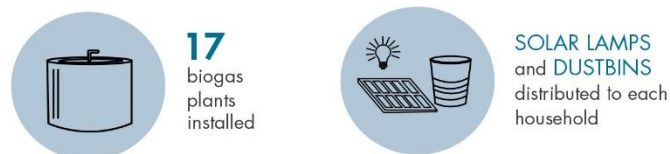
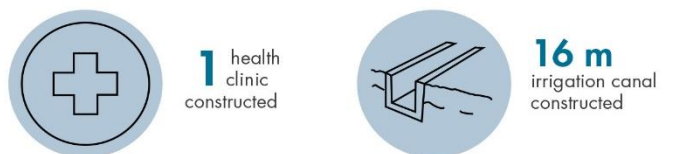
Since none of the development agencies have undertaken any interventions in the village, the villagers of Dhungentar never had an opportunity to any exposure to catch up with the diverse economic prospects offered by the ever changing market system and value chain. At the meantime, enhancing and diversifying agriculture productivity can be crucial to improving resiliency and sustainable livelihood of the Dhungentar community where famers rely entirely on traditional method. Therefore, the project diversified agriculture with necessary infrastructure such as irrigation systems; improved agricultural technologies such as integrated pest management, and post-harvest storage and access to markets in order to increase income and food security of the villagers. The project also introduced a drip irrigation technique to irrigate fields. The livelihood programme also includes investing in farming tools, seeds, agriculture supplies, horticulture as well as establishment of small scale social enterprise.

The project helped to build an agriculture model with an integrated approach to livelihood improvement at the land of Hira Lal Sunar. This approach involves using the by-products

of daily household or farming activities as inputs for other farming activities. For instance, harvested rain water and household waste water collected in a plastic pond can be used for drip-feed irrigation. The model offers diversified source of income, ranging from organic farming in a multi-crop system and floriculture to systematic fishery and bee-keeping, allow for economic security and livelihood improvements. Sunar's agriculture model is expected to act a springboard for community-wide implementation of innovative, modern agricultural technologies that can improve livelihoods and build a resilient mountain village.



Access to Services and Environment Improvement



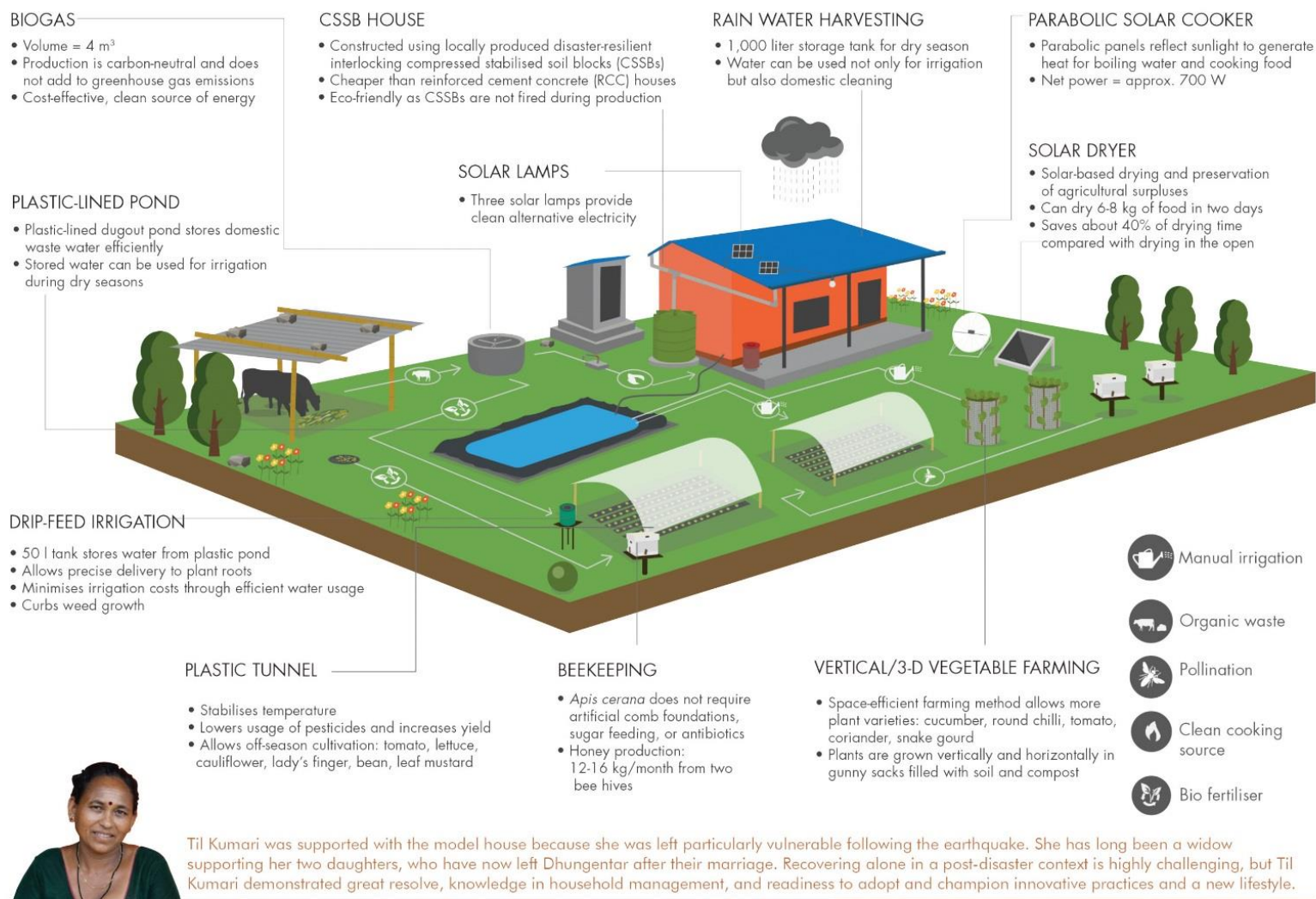
Due to the reliance of the villagers on various ecosystem services for their sustenance and livelihoods, and following ecosystem approach has been used in the project:

- Promoted mountain friendly and green technology such as rain water harvesting, solar powered household and street lamps, bio-gas, clean-kitchen concept, green trails, and agriculture system that are suitable to the area, and high value/ low volume niche products.
- Supported the rebuilding of agriculture and livelihood related infrastructure such as irrigation facilities, cattle sheds, black-smith work shed, water- mill and carpenter shed.
- Plantation of a wide variety of saplings to improve vegetation, mitigate landslide, provide new source of nutrition, and diversify income generation sources.

As part of increasing access to basic services to the villagers, the project made following interventions:

- Built a health clinic next to the multi-purpose community centre so as to place a trained medical personnel.
- Collaborated with e-Sewa- a Nepalese e-commerce company, to recruit local social mobilizers to offer online payment services such as mobile phone recharge, TV subscription payment, utilities payment, and travel booking.
- Collaborated with Nepal Telecommunication and distributor of Dell computer to provide internet access in the community centre.

In an attempt to encourage households in Dhungentar to adopt environment-friendly practices in daily household management, the project partnered with Alternative Energy Promotion Centre to fully fund a model house that showcases an integrated system of water, energy, and farm management. The model house was constructed for Til Kumari Sunar, a widow living alone in Mathillo Dhand, to support a particularly vulnerable beneficiary and encourage her to champion modern, cost-effective practices for daily household tasks.



Community mobilization and improvement of Community Spaces

Formation of community-support institutions



Mothers' Group of Dhungentar



Reconstruction and Development Community



Children's Group of Dhungentar



4

SOCIAL MOBILISERS RECRUITED
Young local women tasked with bridging the gap between project staff and the Dhungentar community

IMPROVEMENT OF COMMUNITY SPACES

Construction of multipurpose community centre



- Community Meetings
- Workshops
- Trainings
- Health Camps
- Child Care
- Cooperative Information Centre
- Emergency Operation Centre



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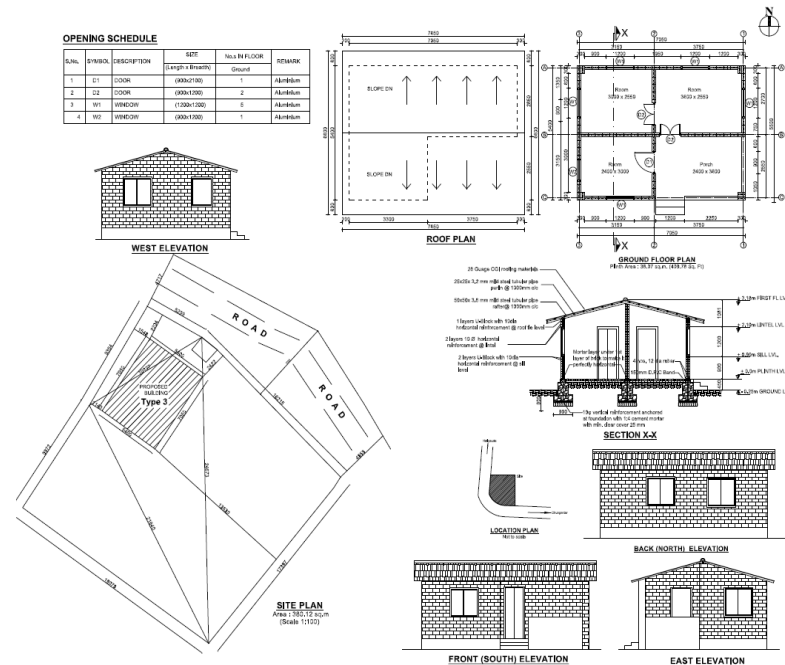
community solar street lamps installed



Improvement of communal chautari space

The RMV primarily focuses on building resilience of community in accordance with the aspirations, needs and interests of local communities. It the community who has the best understanding on the local situation and it is important to ensure the local capacity to prepare for adaptation of climate change and socio-economic development of the village. Therefore, the project considered community mobilization as an integral component of the project and sought to mobilize locals in implementation of the project activities, encouraging community ownership for lasting development. This mobilization began from the beginning of the project with a formation of "Community Based Reconstruction Committee" for participatory decision making on implementing the project activities, including resolving grievance cases. The Community Centre has been handed over in the ownership of the Committee so that the revenue generated from the Centre can be utilized for giving continuity of the project activities. In addition, different community groups were also formed to entrust greater decision-making responsibility to the community. The project also constructed different community congregation areas to create better spaces for discussion, learning, and growth.

Challenges Encountered



Approval of building technology

The final approval of the interlocking building technology took unusually long time, with the approval obtained only at the beginning of April 2017 through DUDBC. In addition three different types of revised house design approved in July 2017 from the same department.

Clarity on the modalities of shelter reconstruction

Though we have made clarity on our contributions from the project for shelter reconstruction, the community is not certain about timely disbursements from the NRA. The NRA disbursements goes directly to beneficiaries, which makes it difficult for availing these funds for shelter reconstruction. The villagers have been encouraged with the two model houses, however, further consultation and feedback from the villagers will be sought on their building requirements, and finalize the type of designs. Some villagers want to option for different modalities other than the inter-locking bricks and ways to provide contributions to these beneficiaries.

Lack of construction workers

It is difficult to get needed technical, skilled and un-skilled workers at the local level. It is challenging to fully mobilize local villagers to work in a dedicated manner in building construction activities. As a result, full scale production of bricks and mobilization for construction of buildings was delayed.

Community participation and brick manufacturing

Many adult male village members were involved in livelihood earning works (mostly in building trade) around surrounding villages and townships. The

community steering committee has not been able to take a strong role in mobilizing and lead the villagers in the building and other activities. Mobilising the villagers to work together on a joint 'owner built' concept has been a challenge.

Disbursement from NRA

NRA modalities of aid delivery are sluggish and prolonged process. Beneficiaries had to wait for more than 3 months to receive the second installment aid as a result there was a delay in reconstruction activities. Only 80% of the beneficiaries have received second installment till date. Regular follow up, meetings with local NRA, DUDBC, engineers has been organised to increase the pace of payment procedure yet, the aid delivery from NRA is gradual.

Inflation of construction materials

Price of reconstruction materials, like; cement, sand and iron rods have gone up by up to 20 percent in the domestic market within three months after elections. Price hike on these reconstruction materials resulted in obstruction of material supply. During the period of price hike, inaccessibility of required reconstruction materials decelerate the reconstruction activities in the project site.

Lessons Learned

Coordinate aid disbursement and partner with private sector organizations

ICIMOD's partnership with the NRA through a memorandum of understanding provided a legitimate basis for the project to operate and also opened up the possibility of scaling up the model to other parts of Nepal. However, coordination regarding aid disbursement presented some challenges. The NRA's earthquake relief grant to beneficiaries, which is given in three instalments after the house being reconstructed meets certain structural requirements, was not disbursed in tandem with the project's own aid disbursement, thereby delaying reconstruction activities. Moreover, the NRA's grant was transferred directly to the beneficiaries' bank account, so it was not possible to ensure that those funds were used in reconstruction. Therefore, in future collaborative reconstruction projects, a coordinated aid disbursement policy is necessary. Policy should be formulated in such a way that the NRA's disaster-relief funds are released to the organization tasked with reconstruction and rehabilitation of the earthquake-affected area, contingent on that particular organization's competency, performance, and transparency. Such a mechanism can ensure expeditious disbursement of grants, proper utilization of funds, and swift progress of project activities.

As the project was conceived as a pilot model village with replication potential in a post-disaster situation, it was also successful in mobilizing private sector co-financing and contributions, not only from a corporate social responsibility (CSR) angle but also from a business development standpoint. As part of their CSR initiatives, private sector companies made substantial contributions to different project components. Although many companies visited the project site and were interested in building business partnerships, the sample size of the village was too small for viable business solutions. However, in the context of the recent decentralization of Nepal's governance system, the project can serve as a development model for a municipality, which would be a suitable market size for private sector companies.

Clearly communicate project support to beneficiaries

Since the project mobilized various complementary resources to each beneficiary, including the NRA's disaster relief grant, it was critical to be clear regarding exact contributions and maintain parity. It is important to communicate to beneficiaries the project's aid delivery modalities and categorically inform them about components beyond the project's scope. This is necessary to pacify demands from surrounding villages that were affected by the earthquake but which fall outside the project area. Clear information dissemination regarding the project's focus area and intervention activities also helps ensure transparency and resist pressure from local political groups.

In Nepal's context, people's willingness to accept aid is greater than their willingness to contribute to collaborative programmes. In Dhungentar, the project implemented various programmes that required voluntary community participation or financial contributions from beneficiaries. However, participation in such programmes was visibly less than that in fully aided initiatives. Project effectiveness increases with local commitment and investment, and community ownership and participation dictates the sustainability of project actions. It is therefore necessary to provide clear information on the support and form of aid that will be provided by the project and the activities that should be performed by the beneficiaries. Proper intervention should be carried out to create awareness among beneficiaries regarding the need for balancing the willingness to accept and willingness to pay.

Build local implementation partner's capacity

The concept of resilient mountain villages incorporated not only post-earthquake reconstruction but also livelihood and community improvement activities to allow Dhungentar locals to live secure and sustainable lives. However, to execute this

vision, the project needed to deal with complex social dynamics and unforeseen logistic challenges, which required extensive planning and pragmatic adaptation. Navigating through ground-level problems requires a dedicated project team working in close coordination with a competent local implementing partner. The institutional arrangement in Nuwakot proved very challenging because of inadequate local capacity and overlapping functions between ICIMOD's field team and the local partner.

A local implementing partner is usually a small organization with expertise limited to local development needs and processes, so it may possess only rudimentary capacity to work in line with guidelines and directives of national and international institutions. Therefore, capacity building training in, for instance, finance and accounting or different forms of reporting, is necessary to enhance their capabilities. To overcome such deficiencies, the project team therefore began carefully planning for contingencies and clearly communicating and delineating responsibilities with partners and beneficiaries. However, it was apparent that collaborating partners required capacity building during the initial phase to ensure smooth implementation of project activities.

Adopt a participatory approach to encourage community ownership

Community engagement is absolutely critical in the design and implementation of the project from the initial stage. This requires careful social engineering and continuous meaningful engagement. Initially, it was difficult to gain the community's trust and encourage participation in project activities. This was primarily because villagers were uncertain about the project's vision and offerings. Moreover, since the majority of the community belongs to marginalized ethnic groups, it was difficult to bring

about a progressive mind-set and a collaborative environment. This was further aggravated by gender imbalance and discrimination: out-migration for employment and indulgence in vices (drinking and gambling) is predominant among local men and women usually do not have financial or decision-making autonomy. Therefore, empowering and mobilizing community members, particularly women, was central to the project's success.

In Dhungentar, a social survey and needs assessment was conducted to conceptualize the project design. Further, locals were engaged in the preparation of a participatory 3-D model of the project site. Using this model, community elders were consulted to learn about the history of different geological hazards and their indigenous disaster response and mitigation knowledge. Significantly, the Mothers' Group of Dhungentar (Dhungentar Aamasamuha) mobilised the womenfolk in various village improvement activities and strengthened the lines of communication between the project team and the community. Similarly, the Dhungentar Reconstruction and Development Community was formed to assist the project by facilitating effective communication with the community, liaising on project implementation, and navigating through entrenched village politics. Particular emphasis was placed on the improvement of the *chautari* and construction of the multipurpose community centre as they serve as important hubs for community information flow and democratic decision-making.

Address village-specific needs with local resources and proven technologies

Any project area's specific needs and strengths should be assessed during project planning to ensure the effectiveness of initiatives. Given the economically disadvantaged status of the Dhungentar community, reconstruction of houses needed

to be cost-effective. Therefore, the CSSB technology – already proven as a cheap and disaster-resilient option in post-earthquake reconstruction around the world – was approved by the NRA and introduced in Dhungentar. Moreover, community members were trained in the production process, which utilized local natural resources. This self-sufficiency not only generated community ownership in the project but also offered local employment opportunities.

The project also learned that it was necessary to find champions of different innovative practices and technologies to achieve community-wide awareness and adoption. As soon as the project was able to deliver in tangible terms and demonstrate its contributions to not only rebuilding houses but also bouncing forward with livelihood enhancement opportunities, there was a noticeable improvement in the community's perception of the project and willingness to participate. Using this momentum, the project identified the following champions to increase community participation in vital areas with potential: Hira Lal Sunar for agribusiness growth, Til Kumari Sunar for environment-friendly and self-sufficient household management, CSSB production trainees for the establishment of an enterprise, and the project's social mobilisers for the use of technology for development. Demonstrating tangible benefits of newly introduced practices and technologies is an effective way of propagating them throughout the community. For example, Hira Lal's agriculture model used a plastic tunnel to introduce mushroom farming in Dhungentar's subtropical climate, which locals generally assumed would not be favourable for mushroom production. Local champions can therefore shift community perceptions by showing possibilities.

Optimise choice and introduce safer practices

Instead of providing a single architectural design, the project gave a range of structural design options, technologies (CSSB or RCC), and general guidelines for seismic resistance. This allowed for choice and interpretation according to site, budget, and aspiration of household. Individual choice was optimized while safety standards adhered to.

Facilitate market linkage for more opportunities

Proper market linkage can help promote entrepreneurial activities and agribusiness ventures, thereby allowing communities to become resilient and flourish. Dhungentar's infrastructure was improved to establish the foundation for self-sufficiency. After the reconstruction of private houses, roads and trails were constructed to ensure access and connectivity. Subsequently, traditional structures supporting livelihoods such as watermills and blacksmith sheds were improved to allow resumption and growth of income-generating activities following the earthquake. Skill-based training was then imparted to locals, mostly women, to encourage small-scale entrepreneurship. The agriculture model demonstrated the potential for agribusiness in the community.

In this manner, Dhungentar's capacity to fully utilize local resources and strengths was raised. With better road connectivity, transport of goods became easier. However, Dhungentar locals required networking and market knowledge to reach local businesses in Battar, and the locals' inexperience in this area meant they could not properly market their home-made or organic products. This was a major oversight in the project's planning for livelihood opportunities. Training programmes are needed to build people's business acumen, and establishing different cooperatives can help businesses sustain by providing access to credit. In the initial phases, commitment is needed from local businesses to maintain transactional relationships with such aspiring, inexperienced entrepreneurs.

In-site reconstruction should be the first priority

The project had initially thought of relocating Archale settlement with around 19 households to a safer area as the settlement is located in landslide prone area. The geo-hazard assessment concluded that the area is less prone to large geo-hazard events if no major alteration of environmental and topography is done. Accordingly, the project abandoned relocation of the settlement and assisted villagers to build their shelter in situ. The villagers also preferred to stay where they are.

Demonstration is needed for introduction of new technologies

At the beginning, the villagers were reluctant on adoption of livelihoods related new farming technologies. The project helped Hira Lal to establish an agriculture model farm as a demonstration plot to show farming without use of chemical pesticides, and to introduce bee-keeping, fish farming, mushroom farming and floriculture for the first time in the village. At the meantime, the villagers were not much interested on use of CSSB bricks as the technology is newly introduced in Nepal. The project made two model houses to demonstrate the technology is earthquake resistant and financially economic. Seeing success of the farming techniques and CSSB technology, the villagers are convinced on adoption of the technologies.

ICIMOD believes on that the demonstration project will have demonstration effect to showcase the project for sustainable reconstruction and rehabilitation in a post-disaster situation, with the potential for up-scaling and wider knowledge dissemination.

Overall Assessment and Recommendations



With the handover ceremony of the pilot demonstration project on 17 December 2018, ICIMOD witnessed a sense of happiness and security among the villagers as they have their own earthquake-resistant houses and they are recovering their livelihoods and economic activities after reconstruction of the shelters. The project did not only focus on physical reconstruction of houses and infrastructure, but equally emphasised on strengthening social capital and environmental stewardships, resulting return of their life better than pre-earthquake conditions. The project managed to create hope and bring smiles of villagers' face, once shattered by devastating earthquake of 2015. It was a moment of joy and celebration, and a culmination of tireless efforts towards a road to recovery and resilience.

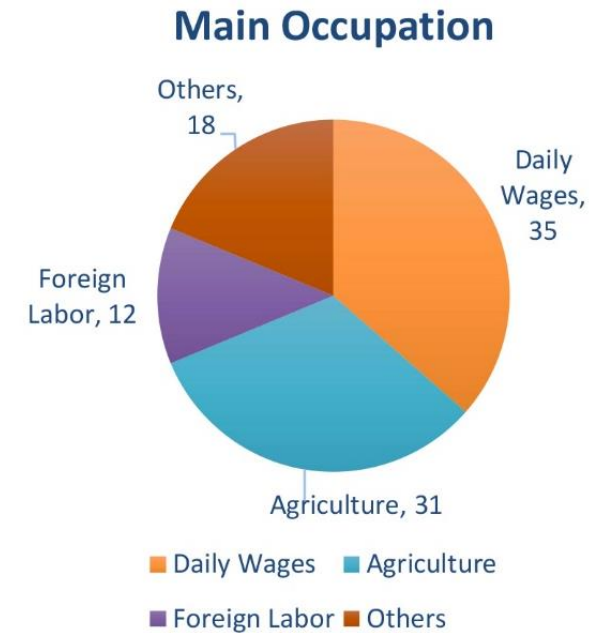
In overall, the project helped Dhungentar villagers to rebuild, recover, and rebound in a manner that insulates them from future shocks. The project adequately managed to address infrastructural frailties, reduce socioeconomic vulnerabilities, and elevate the living standards of Dhungentar local, thereby building a resilient mountain village that is smart and adaptable to change. The locals' inherent resilience is reflected in their efforts to rebuild from the rubble, and their willingness to adopt new practices and technologies indicates their appreciation of the need for change. IDRC's flexibility expressed towards the project on reallocation of funds to components according to need and priority was instrumental to success of the project. ICIMOD values value addition of multi-stakeholder partnership during the project implementation - government agencies, local institutions and NGO partners, development agencies, knowledge partners, various private sector actors and, most importantly, the community itself.



Based on the lessons of the project, ICIMOD recommends followings for future reconstruction efforts to be more resilient:

- i) The recovery, rehabilitation and reconstruction phases following the earthquake had provided ample opportunities to build back better and ensure greater resilience of the earthquake victims to earthquakes in the future. Yet most of the efforts are concentrated on reconstruction of shelters without much giving emphasis on other measures to support build back better: introducing improved technologies and improving socioeconomic status of the earthquake victims to uplift their living standards. Adoption of an integrated approach, similar to the RMV approach adopted by ICIMOD, in future reconstruction efforts would not only ensure food security and livelihood recovery in the reconstruction efforts, but respective country also meets its commitments under the Sendai Framework for Disaster Risk Reduction.
- ii) One of the main advantages of the field survey, topographic survey and geo-hazard assessment is that ICIMOD could prepare a Master Plan based on which ICIMOD implemented the demonstration project and adequately plan land use so that the available land could be used for carrying shelter reconstruction, construction of infrastructure, undertake livelihood and environmental services activities to make the village more resilient to future shocks. Therefore, the future reconstruction efforts are recommended to plan the land use prior to initiating the reconstruction and give adequate attention for undertaking activities to be more resilient.

ANNEX I: Dhungentar Village- preliminary assessment



Dhungentar village area is approximately 0.25 km² (2,500 hectares) comprising of approximately 100 households. The village is approximately half an hour drive from Batar Township which is close to Bidur the capital of Nuwakot district. The village is connected by an unsealed road from Batar. The village lies at an elevation of approximately 700 m, has a tropical climate setting, and easily accessible by road from Kathmandu (around 2.5 hours drive) and other townships.

Post-earthquake data, inspection and discussion with villagers show that almost all houses have suffered damages and are unsafe to live in. Many houses have been completely flattened. A few villagers have built new houses post-earthquake. Fortunately there was no death or physical injury due to the earthquake.

The village is characterized as an agrarian community where most of the people are farmers, laborers both skilled and unskilled. Main crops are rice, maize, millet, and wheat. The villagers grow small amount of vegetables and raise cattle, goats and poultry in a small scale. Many of them

work as daily wagers, and a large number of them are in skilled professions such as buildings, tailoring, metal smith, jewelry, shopkeeper, porter, and electrician. Many of them reside in the village, or work in nearby villages and townships, or they work in Kathmandu. A few of them have migrated outside the country, mostly to Gulf countries as foreign laborers, and it is not unusual for them to return back to their family once in six months to over two year interval. The annual income of the villagers ranges from very low to medium of around NRs 5,000 to NRs 300,000. As government social security system is non-existent or negligible, villagers with no to very low income depend on financial, emotional and other livelihood support from close relatives.

Dhungentar village was identified as a marginalized and disadvantaged community amongst the relatively affluent and influential surrounding communities. The ethnic composition of the village comprises mostly of Sunar, B.K, Mijar, Tamang, Lama, Nepali, Pariyar and Kami followed by small households belonging to Khadka and Aryal. Irrespective of gender and caste, the villagers give priority to provide education for their children.

Women in general look after the family and farm. It won't be surprising that they still have a big say in the running of the house and family, including responsibilities and boundaries for men and women, and husband and wife, in general.

There is negligible infrastructure implemented in the village in the form of irrigation, water supply, education facility, or pathways for villagers to access skill, trainings, or other government or non-government capacity building and employment opportunities. Most of the adults have no formal or lower school education, and even though they can read and write, they are not categorized as entirely literate.

The agriculture land area owned by the house owners is 0.25 - 5 ropanis (1 ropani= 74X74 sq ft). The main sources of drinking water and agriculture comprises of tap, stream, irrigation canals and springs. Nearby communities who have more capital and stronger government connections have managed to bring tap water and irrigation water for their benefit. The marginalized group in this Pilot village project are disadvantaged and left out from availing these opportunities.

The main diseases suffered by the villagers are rheumatoid arthritis, asthma, gastritis, tuberculosis, uterus problems, blood pressure, paralysis, leprosy, including common complaints of headache and stomach issues. There is a health post in nearby Khadka Bhanjyang, otherwise they have to go to Batar which is around 5 - 7 km away. Villagers have to go to Kathmandu for other specialist or life threatening treatments. Traditional treatments by Shamans is still practiced in the hope of freeing oneself from sufferings.

Professional and well-structured skill trainings are lacking. Villagers are not motivated to join social, political or government led programs, and these factors also disadvantage the village in accessing adequate support for reconstruction efforts. The local population for eager for reconstruction activities, and it is important to empower and motivate the villagers that will help in uplifting their livelihood and in rebuilding their damaged village.

ANNEX II: Visitors in the Project Area

A numbers of visitors from National and International organizations, communities and individuals have visited the pilot. The visitors were mainly from following organisations.

- Aalto University, Finland
- Alternative Energy Promotion Centre (AEPC)
- Asian Institute of Technology and Management (AITM)
- Biogas Sector Partnership-Nepal
- Chinese Academy of Science
- Center for Rural Technology (CRT)
- China Build up
- Creative Private Consultant
- District Agriculture Development Office (DADO)
- DUDBC
- Global Alliance for Clean Cook Stoves (GACC)
- HRRP (Housing Reconstruction and Recovery Platform)
- IDRC
- Japanese team
- Manushi
- Ministry of Home, Bhutan
- Municipality
- Nabil Foundation
- Norwegian Embassy
- NRA
- Nursing college, Nuwakot
- Oxfam
- Rapti Renewal Energy Private Biogas company
- Rotary
- Rupantaran
- Save the Children
- Transparency International

ANNEX III: Key documents and reports



ANNEX IV: Project Team

ICIMOD

Overall Concept Design and Guidance

Basanta Raj Shrestha, Director Strategic Cooperation

Head Office staff

Naina Shakya, Partnership and Private Sector Specialist

Kundan Shrestha, Content Producer

Field Office staffs

Govinda Joshi, Project Coordinator (Aug '17- Dec '18)

Achut Man Singh, Project Coordinator (Apr '16 – Jul '17)

Ram Kumar Tamang, Reconstruction and Rehabilitation Assistant

Sunil Tamang, Reconstruction and Rehabilitation Assistant (Apr - Dec '17)

Ramesh Singh, Reconstruction and Rehabilitation Assistant (Jan- Oct '17)

Sahayata Samajik Sanstha

Santosh Rijal, Project Coordinator

Deepak Pathak, Livelihood Officer

Laxman Khadka, Sub-Engineer

Sarmila Sunar, Social Mobiliser

Samikshya, Social Mobiliser

Apsara Sunar, Social Mobiliser

Bhawani Sunar, Social Mobiliser

Innovative Design Pvt Ltd

Bishal Raj Vaidya, Engineer

Sijan Joshi, Civil Engineer

Dikshant Gautam, Sub-Engineer

Ghanshyam Khadka, Sub-Engineer

Rakshya Kunja Supply Pvt Ltd

Tirtha Bahadur Bajgain, Labour Supervisor

Sameer Sapkota, Labour Supervisor

Ganga Prasad Dabadi, Labour Supervisor

ANNEX V: Partners

CORE PARTNERS



Government of Nepal
**National Reconstruction
Authority**



IDRC | CRDI

International Development Research Centre
Centre de recherches pour le développement international

COLLABORATING PARTNERS

The following organisations were involved in the implementation of the project's core activities at the local level:



सहायता सामाजिक संस्था नुवाकोट
Sahayata Samajik Sanstha
Bidur, Nuwakot



GOVERNMENT PARTNERS

ICIMOD acknowledges the guidance and cooperation of the following government bodies during the implementation of the project:



- District Coordination Committee (DCC)
- Bidur Municipality
- Department of Urban Development and Building Construction (DUDBC)
- District Administrative Office
- District Agriculture Development Office (DADO)
- District Horticulture Office
- District Disaster Risk-Reduction Committee (DDRC)
- District Emergency Operating Centre (DEOC)
- District Forest Office (DFO)
- District Soil Conservation Office (DSCO)
- Nepal Electricity Authority

CO-FINANCING PARTNERS

ICIMOD expresses its appreciation of the following co-financing partners for their financial contribution towards different project activities:



Government of Nepal
**National Reconstruction
Authority**

Co-financed the reconstruction
of houses



**Alternative Energy
Promotion Centre**

Co-financed the construction of biogas
plants; contributed 96 sets of solar lamps for
all households; two 1,200 W solar panels
for community solar street lamps



Supported the construction of the
multipurpose community centre



Donated 100 units of
Aquabox - water filter to each household

PRIVATE SECTOR PARTNERS

The involvement of the following private sector partners was integral to the project's livelihood improvement and capacity-building activities:



SAROSH PRADHAN AND ASSOCIATES
ARCHITECTURE . INTERIORS . GRAPHICS



KNOWLEDGE PARTNERS

The following organisations were instrumental in creating and disseminating knowledge related to reconstruction and rehabilitation in Dhungentar:

