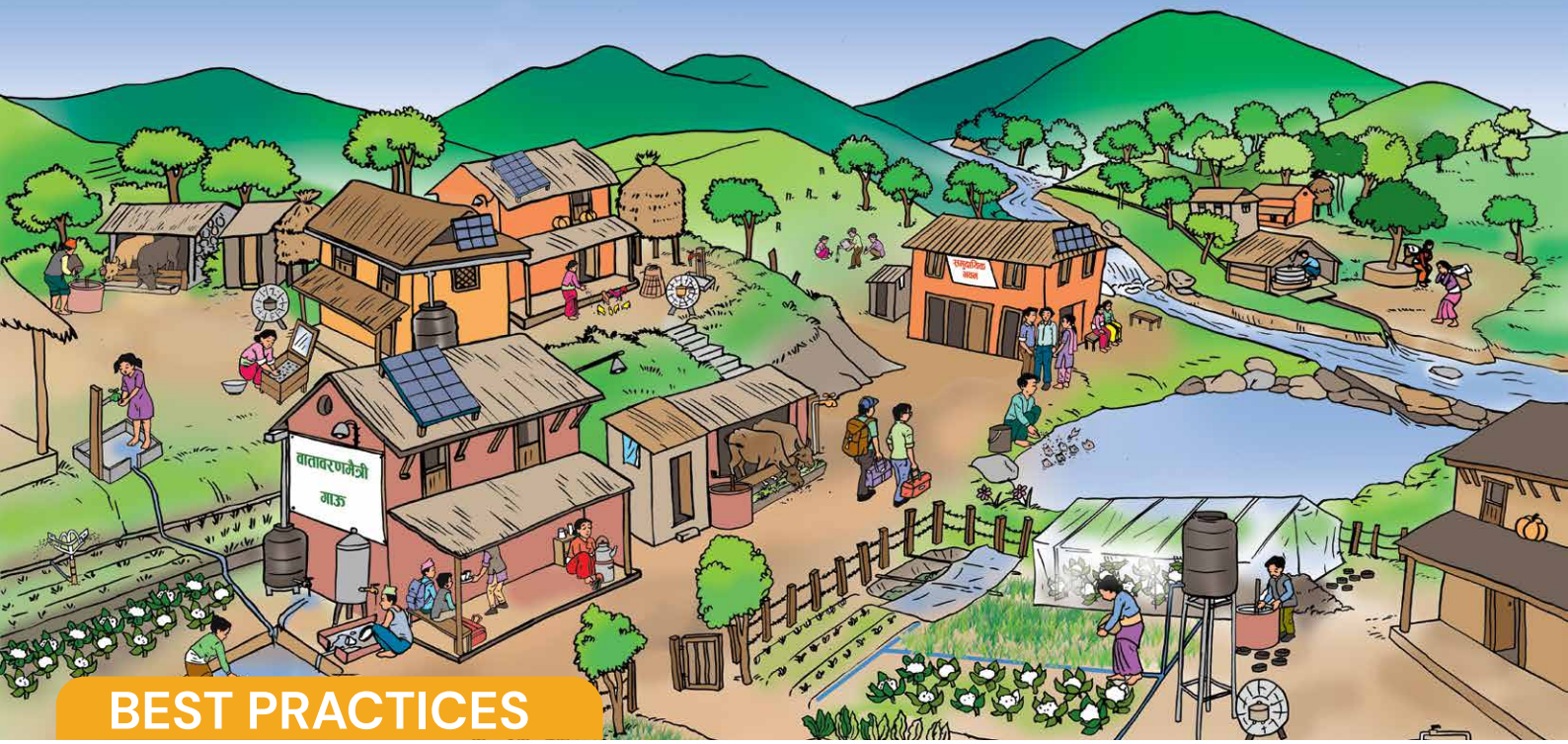

BEST PRACTICES

Eco-Village Development through Integration of Renewable Energy Solutions and Climate Friendly Activities for Enhancing Livelihood of Rural Communities in Bethanchowk Rural Municipality, Kavre District

Project Beneficiary Perception

Ram Krishna Khatri is a resident of Dandagaun-5, Bethanchowk Rural Municipality. He is also the Chairman of the Project Beneficiary Committee (Nawa Urjasheel Krishak Samuha). The committee comprises of 9 members (Males: 4 and Females: 5) including the chairman, secretary, treasurer, and general members. These members were selected by the community members. The committee has been registered as an agriculture group to instill ownership of the project at the local level. The committee was made responsible to coordinate with the project beneficiaries, procuring the eco-solutions and Renewable Energy Technologies (RETs), and monitoring and evaluating the installation of the eco-solutions and RETs. Under this project, the committee has also maintained an account at the local bank where the seed grant was transferred by Centre for Rural Technology, Nepal (CRT/N) to carry out the procurement and dissemination of eco-solutions and RETs efficiently and transparently.

Ram Krishna finds the project to have upgraded the traditional livelihood practices by making optimum utilization of local resources. It has simultaneously improved the lifestyle of the villagers. He believes that the technologies which were disseminated to the project beneficiary had provision of concession in the market price. Different technologies and eco-solutions had different financial support mechanism. The project had a mandate where every project beneficiary household had to make financial contribution and/or kind contribution to own or purchase varieties of eco-solutions or RETs.

SGP The GEF Small Grants Programme

gef

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CRT

Ram Krishna quotes, *"The basket of eco-solutions and climate-smart practices along with capacity building training to utilize and practice eco-solutions and climate-smart endeavors have not only made us climate friendly but have also played important role in reducing the stress level of the villagers to some extent by reducing their daily drudgery."*

Ram Krishna further adds, *"The project has helped the villagers to be more conscious towards their health and in contrast to the past drudgeries and how a better eco-solution can enhance their lifestyle using the local resources. In the beginning, even the households that were not ready to adopt eco-solutions had later requested and adopted them after observing the benefits of those solutions within their neighborhood."*

Solar Energy for Micro-Enterprise

Surya Maya Lama, 44, along with her husband is currently running a homestay. The homestay provides service to 15-20 guests in a month. Both the guests and the family loves eating dried meat and off-season vegetables. Surya Maya says, *"The solar dryer dried leftover meat and gundruk (fermented vegetables) along with vegetables are hygienic and preserves taste and color of the food. The desirable food items can be dried easily, quickly and efficiently, as compared to open sun drying. I appreciate how the project has taught us to integrate these technologies with our livelihood."*

Before using the solar dryer, the family used to dry the food items in the open sun over a plastic sack which was unhygienic and attracted flies therefore had to be attended regularly to turn them away. The leafy vegetables and radish dried in the solar dryer are completely dried and free of moisture hence last longer. In contrast, when these food items are dried in the open sun, fungus are developed during and after due to traces of moisture left in the food item.

65 years old Yagya Bahadur Khatri, and his wife, Bhawani Khatri have been involved in making Lapsi (Hog Plum) Candy for many years. Traditionally, the couple used to dry the hog plum in corrugated sheet roof under direct sunlight or by hanging on the wooden or metal support. Such drying process was unhygienic. Moreover, Yagya reports that there is high chance of fungal damage in the traditional drying process.

Understandably, he was elated at the opportunity to install solar dryer for his candy business. In the candy making process, the pulp from the ripened hog plums is seasoned and is dried before shaping them into the square shaped candies. The pulp dried in the solar dryer is free of dust and the drying time is minimized compared to open drying. However, since the drying volume is more than the capacity of the solar dryer, it requires manual intervention and the drying time for an entire batch of pulp is more compared to open drying which can be done at once over the corrugated sheet roof. As of now, Yagya is happy and satisfied with the solar dryer and wants to buy solar dryer, twice as big as the one he is using so that he can increase his production and up-scale his candy

business. As far as the sales of the candy is concerned, previously his market was outside his village but now since the villagers have had firsthand experience of his drying process involving solar dryer, they are purchasing the candy from him. Last season, he had sold 20 kgs of Lapsi candy worth NPR. 11, 000. During the off-season when there is no production of the hog plum, Yagya is using the dryer to dry leafy vegetables to produce dried fermented vegetables (गुन्द्रुक) and radish for self-consumption. The capacity of the solar dryer disseminated in the village was 3 kg/batch.

Stacking Clean Cooking Solutions to Reduce Indoor Air Pollution (IAP)

Sarita K.C, 28 is a health worker as well as a farmer. Being a health worker, she values her family member's health and her time and makes choices accordingly. Unsurprisingly, she prioritized using clean cooking solutions to prevent IAP and reduce the cooking time significantly. Sarita is using a 1 m^3 capacity "Alternative Portable Biogas" to fulfill her cooking needs.

"When I saw the alternative biogas during the technology exhibition and demonstration organized in my village, I found its portability aspect the best." says Sarita. She further explains, *"The technology has two-fold advantages; household waste management and energy production for clean cooking. I can use the organic wastes produced from my kitchen along with cow dung as a substrate for biogas production."*

She further adds, that with the biogas system, she does not have to use firewood to prepare tea and snacks. Preparing tea and snack is a simple task and does not require much time but having to ignite fire in either traditional or Improved Cook Stove consumes significant time than to prepare tea and snack. The biogas system has been saving her time spent on cooking. She uses the biogas twice in a day, in the morning and in the evening for preparing tea and snacks.

On the downside, the performance of the biogas is compromised during the winter season as the ambient temperature at the location is low and the digestion process is slowed down. The low temperature ceases much of the gas production. Overall, biogas has helped to minimize the annual fuelwood consumption at her household. The project has also provided repair and maintenance training where the users including Sarita were trained to differentiate between organic wastes that can/not be used as the substrate for the biogas production. Sarita is well aware that she cannot use organic wastes like citric fruits like lemon and tomato that can potentially cause damage to the microbials.

Sarita has also installed Matribhumi ICS in her kitchen. Cooking with a traditional cookstove was challenging as IAP was a nuisance for Sarita. Additionally, traditional cookstove also consumes much more firewood. She finds mud-based ICS more practical for preparing her daily staple meal. Sarita speaks, *"ICS is the best cooking technology that I have as it has better combustion due to the provision of a burner and the smoke cannot*

escape within the kitchen. Before, while using the traditional cook stove, approximately 40 Kg of firewood would last for not more than 4 days but since I started using ICS, the same amount of firewood is now enough for 5-6 days depending upon the food I cook. Save in the fuelwood consumption has helped me to understand the efficiency of the ICS." Like every other mud-based ICS, the Matribhumi model also requires regular coating with the mud-water slurry. Other than that, the user is required to clean the chimney at least once every two months. Sarita adds, *"The protocol involved to clean and maintain the chimney is simple and the capacity building training was helpful to understand the drills required to maintain the ICS."*

Compatibility of Mud-Based Improved Cook Stove in Rural Cooking

Nanimaiya Tamang is 31 years old, and a farmer by profession. She has been using Improved Cook Stove (Matribhumi). Like most other women in the project beneficiary community, Naninmaya also opted for clean cooking solution for her kitchen. For Nanimaya, cooking with traditional cook stove was challenging as Indoor Air Pollution (IAP) was a nuisance for her. Additionally, traditional cook stove also consumed much more fuelwood. Nanimaya Says, *"I am using only 1/3rd of firewood in this ICS compared to the traditional stove to cook meal for my family."*

The design of the ICS allows efficient use of the fire. The design allows fire to spread across the two pot holes. For repair and maintenance, Nanimaiya was mainly trained to clean the chimney. Initially, she found the cleaning of the chimney quite tedious. However, soon she realized that the unmaintained chimney reduces the efficiency of the stove. Other than this, as a part of repair and maintenance, Nanimaya is regularly maintaining the ICS by cleaning and coating it with mud-water slurry. The innovative part of the ICS is the integration of the burner in this stove. The burner comprises of seven perforated conical projections placed at the bottom of the fire chamber which facilitates efficient supply of air contributing in higher combustion efficiency of the fuelwood. Nanimaya quotes, *"The burner made out of cast iron is very useful as it helps to maintain the fire temperature relatively high for a longer period of time contributing to reduction in the heat loss from the stove while cooking."* She is fully satisfied with the ICS and suggests other villagers to use them.

Climate Smart Agriculture Practices

Indira Dhital, 30 years old, is a farmer by profession. She has recently started commercial vegetable farming using the poly tunnel house, integrated with drip irrigation. Before this, she had been involved in the commercial potato cultivation.

Aspiring commercial farmer, Indira says that *"The crops grown inside the tunnel require less fertilizer, irrigation and maintenance. Integrating the drip irrigation system with the poly tunnel has helped me to manage the water resources for irrigation. Combining these two practices has enhanced crop production and longevity."* In her poly tunnel (size 11.5mx5.5m with thickness of 90 GSM), she uses farmyard manure with urea along with a mixture of cow urine and water as the fertilizer.

The project has provided her with the capacity building training where she is trained to build the poly tunnel house and vegetable (Tomato and Cauliflower) cultivation practices under the tunnel by integrating drip irrigation system. Following the training, she brought the required quantity of bamboo locally, then built the framework. The plastic sheet covering to the frame and a 100-liter drip irrigation system was provided by the project.

This season, she had planted 80 cauliflowers inside the poly tunnel. Cauliflowers were her first harvest and excluding the self-consumption, she

was able to sell around 70 kgs of cauliflowers at the rate of NPR. 40 per kg, earning total of NPR. 2,800. This is not lucrative return but Indira is determined to apply the knowledge and skill she learned from the project to increase her productivity. She further plans to build additional tunnels and grow cucumber, beans, and zucchini inside the tunnel in the upcoming summer season. She appreciated the skill development training provided by the project and believes that such skills can inspire people like her to start their small enterprises.

Water Management for Climate Resilient Agriculture

Padam Kumari Khatri, 58 years old, has built a Plastic Pond to manage the existing water resources to use in her farmland. Being a farmer, irrigation has always been a major challenge for Padam Kumari, as only drinking water is available at her residence which is located on the hilltop. She is collecting the excess drinking water in her plastic pond to use for irrigation in her poly tunnel and farmland.

Plastic Pond allows local farmers to collect surplus water supply and reclaim grey water in a

pond for irrigation purposes and household works. The same pond can also be used to harvest rain-water during monsoon. Padam Kumari has built the pond near her cultivable land and also has a poly tunnel house. For the poly tunnel house, she fetches water from the pond and utilizes it in the drip irrigation system. Padam Kumari says, *"Using the water stored in the plastic pond, I have managed to increase the production of potatoes from 21 sacks (approx. 50 kgs) to 26 sacks."* Padam Kumari was trained to select site to build the plastic pond. However, she hired laborers and directed them as per the knowledge she gained.

Usha Sunar, 38 years, resides in Dandagaaun-5, Bethanchowk which lies at the uphill where the water availability for irrigation is scarce, hindering her to practice commercial farming. Usha is currently involved in rainfall dependent subsistence farming. She used to collect excess drinking water in a 500-liter drum for irrigation and grow the vegetables in her kitchen garden during the dry season.

Recently, she has excavated rectangular pond (9ftx12ftx3ft) with a reservoir capacity of 5,000 liters which she intends to use for irrigation. At present, she is using the pond water to irrigate the crops (chilies and tomatoes) in the poly tunnel house. Her plastic pond is also recharged by the excess drinking water flowing from four neighboring households. Even though it has not rained since the excavation of the pond, the gutter is set on the roof of her house to harvest the rainwater and collect in the plastic pond. The excavated pond is shallow, not compromising the safety but wide enough to collect the water. She says, *"The drum I used to collect excess drinking water was not enough to irrigate my whole cultivable land, my plots remained fallow during the dry season. After building this pond, I have been able to store more water and use for irrigation which is sufficient to irrigate area under my poly tunnel house. This solution has greatly solved my problem."* For the project beneficiaries who were interested in building plastic ponds, capacity building training was provided.

61 years old Hem Bahadur Damai is a tailor by profession. Like many other villagers, agriculture is integral part of his livelihood. He resides uphill, away from the major water source for irrigation. However, he used to collect greywater from the kitchen and bathroom in a small excavated pit and use it to irrigate the kitchen garden. Five months back, following the training and lesson learned, Hem Bahadur adopted Rain Water Harvest (RWH) with an intention to collect the rain water from his roof. Hem Bahadur fitted a gutter along the edge of the roof to channel the rainwater into a 1,000 liters drum. Hem Bahadur also envisage to collect rainwater into his plastic pond. He has constructed a system which allows rainwater to be collected into the 12,000-liter plastic pond. Both, the rainwater harvesting system and plastic pond is intended to be used for irrigation and become self-sufficient in vegetables. Hem Bahadur says *"Using the Rain-Water Harvest (RWH) system, our family has become self-sufficient in terms of vegetable production throughout the year. Before, due to the lack of irrigation, we could not grow vegetables during the dry season. This winter, I used water collected at my plastic pond to grow green vegetables like broad leaf mustard (रायो),*

radish, garlic, garden cress (चम्सुर). Now that I have knowledge of RWH, every time it rains, I feel happy knowing the fact that the rainwater will not go in vain instead be collected in the drums and/or plastic pond for later use for irrigation." The plastic pond that he has built of size 6m x 6m x 1m. In order to avoid accidental risk, he has planned to install safety fence around the pond.

New Avenue for Clean Cooking: Induction Cook Stove

Januka Thapa, 28, is a newly married housewife. She finds cooking very difficult and tiresome mainly due to the time required to ignite the fire in the traditional stove and the resulting smoke inside her kitchen. There are multiple types of cook stoves in her residence; LPG stove, traditional stove and induction cook stove. She uses all of them depending on the type/quantity of meal to cook. With the introduction of the induction stove, the frequency and time of using LPG stove and traditional stove have declined resulting in less consumption of fuelwood and costly LPG cylinder respectively.

The households that wanted to cook in the induction cookstove stove were provided with the utensils (pressure cooker-5 liter and a circular pan-14").

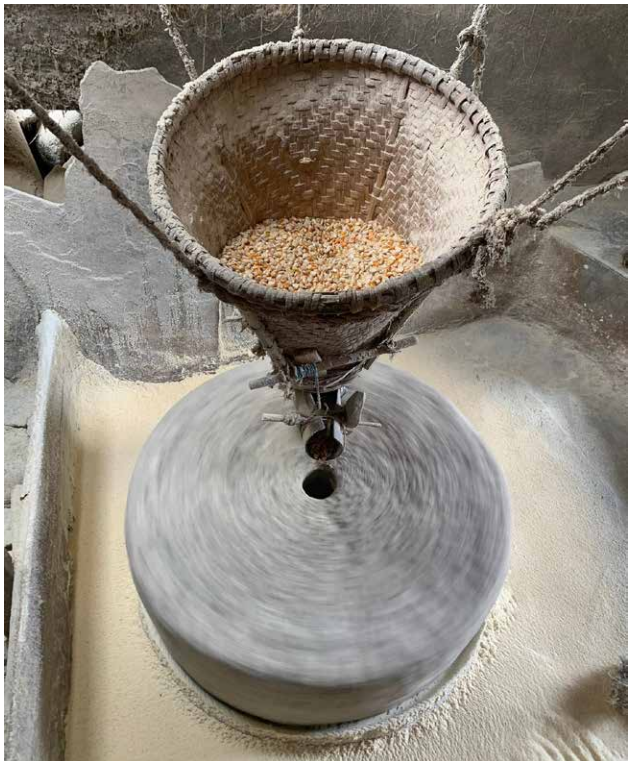
She decided to use induction cook stove mainly to save the consumption of LPG and also to reduce her workload associated with cooking. Januka says, *"When I bought the induction stove, I was taught to operate it by the project. Initially I was hesitant to use the induction stove as there were lot of modes and functions. But now, I know how to use different mode which has enabled me to choose the right temperature to cook specific meal. The automation in the induction stove allows me to multi-task while the food items are being cooked. I do not have to stir the meal or check the fire and even bear the smoke as I had to with the traditional cookstove. With the traditional stove, the kitchen used to get dirty but now with the use of induction stove, the kitchen looks much tidier."*

Januka uses the induction stove for cooking rice, making tea, and boiling milk. Januka is happy to learn that her LPG consumption has been reduced to half even though she noticed an increase in her electricity bill. Likewise, she also reported consuming a relatively lesser amount of fuelwood after she started using the induction stove. The only demerit Januka mentioned about the induction stove was not being able to use all the cooking pots she has for cooking.

The 40 Years Old Improved Water Mill Still is the Integral Part of Rural Livelihood

Gita Khatri, 55 and her family including her son, Pradeep, 20 operate the mill. have been running a water-mill business in their village. The Improved Water Mill (IWM) is owned by Kamal Khatri but he has allowed Gita and her family to operate the IWM with terms and conditions that includes sharing of the profit made. 20 years ago, the water mill was improved by replacing wooden turbine with the efficient metal turbine. Likewise, the hollow carved piece of wood that was used to channel water towards the turbine was replaced with penstock pipe and nozzle which increased the efficiency of their water mill. The IWM has been one of the most robust appropriate technologies that has been serving many rural communities.

IWM being a simple technology that operates using the kinetic energy from the water requires minimum repair and maintenance. The financial support from the project was used to renovate the roof; the corrugated sheet metal used for the roof of the mill was replaced by transparent fiberglass sheet to take maximum benefit of the daylight. Additionally, the flooring on the mill has been smoothen using cement mortar. This has enabled mill operator to collect the crushed cereals (maize and wheat) with minimum post-processing loss. Gita says, *"Processing cereal crops in the IWM is a blessing for me. After loading the hopper with the cereal crops, I can keep the track of time and perform other household chores. Usually, approx. 24 kg (10 पाथी) of cereal crop can be grinded in 17 minutes. The improvement in the mill has definitely contributed to increasing the milling efficiency and quality. I really appreciate the support I received form the project to renovate the mill. This support has enabled me to work with much more ease within the mill."* By operating the IWM, instead of charging money to the customers, the customers leave certain percentage of processed cereal crops to the mill operator.



Vermi-Composting and Bio-Pesticides for Climate Resilient Farming

Swosthani Khatri, 49 years, along with her husband are farmers. The couple had been practicing traditional farming and were using farmyard manure along with other chemical fertilizers in their farmland. Through this project, Swosthani had an opportunity to participate in capacity building training of vermi-compost. After participating in the training, she has developed better understanding about the benefits of using vermi-compost in the soil over chemical fertilizers. She is now putting her learning into practice. The

project had provided her with 1 kg of vermi-worms as input support. Since then, she has been producing the compost which she uses in vegetables cultivation, especially potatoes, and have found a significant difference in the condition of the plants and the soil. She feeds biodegradable waste produced from her kitchen and farmland to the worm. Apart from using the vermi-compost in her farmland, Swosthani aspires to sell it in the market. She says, *"I believe vermi-compost improves the soil resilience and it has no health and environment hazards. I am willing to let go of all other works and devote my entire time in production of the vermi-compost and I am looking for opportunities where the vermi-compost and/or vermi worm can be sold." Since March 2021, she has produced 90 kgs of vermi- compost. The worm population in her vermi-bed has also expanded significantly. She claims "I have reduced the use of chemical fertilizers by 50 percent since I started producing and using the vermi-compost."*

27 years old Bhagwan Khatri is a part-time soap-opera actor and has been practicing agriculture for a very long time since he belongs to a farmer family. He was very much interested to learn and practice making Jholmol (झोलमल) -the liquid fertilizer, that can be used both as pesticide and fertilizer. Bhagwan is also a general member of the Project Beneficiary Committee. Initially, he found many of the households in his locality were not interested to adopt any of the eco-solutions that were to be provided by the project. He felt it was his responsibility to raise the awareness of his community inhabitants and become an instigator to develop his village into energy and climate-resilient village.

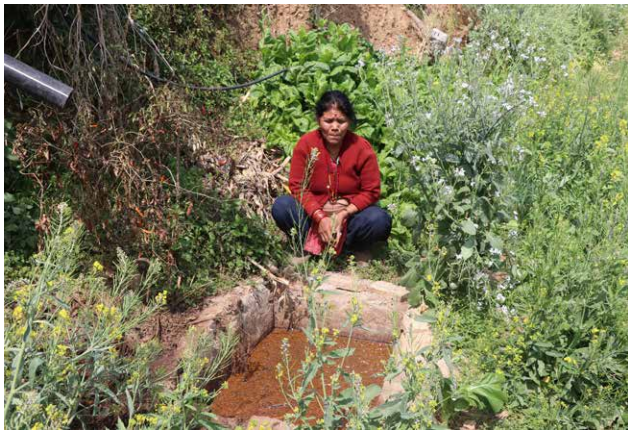
The project has provided capacity building training to produce bio-pesticide. Before, participating in the training, he used chemical pesticides but used manure which he prepared by traditional pit method. Following the training, he has started using bio-pesticides in his poly tunnel house and consequently, have found minimization of diseases in his cultivated vegetables, namely, aphids in cauliflower and blight in potatoes while the soil has loosened up. Bhagwan recollects, *"The production of potatoes increased by 1.5 folds from 29 kgs to 43 kgs after I abolished using chemical fertilizers and pesticides and replaced them with vermi-compost and jholmol. I can prepare bio-pesticides using locally available resources like insecticidal plants (stinging nettle, szechuan pepper, tobacco leaf, chinaberry leaf, lantana, needle wood leaf, neem, pepper leaf), animal urine, animal dungs and water which has contributed in saving cost which otherwise would have been spent on purchasing chemical fertilizer and pesticides."* Currently, he is also using jholmol in tomatoes and chilies inside the poly tunnel. For the households practicing production of Jholmol the project provided the beneficiary households with the capacity building training along with three drum (50 liters each) and Effective Matter (EM) Organism.

Cowshed Management to Improve Sanitation and Produce Organic Fertilizer

Kanchi Maya Tamang, 59 years, lives with her husband and two daughters. She raises a cow and a buffalo in a small cowshed built by her husband. The couples are making a living by selling the milk to a local milk collection center.

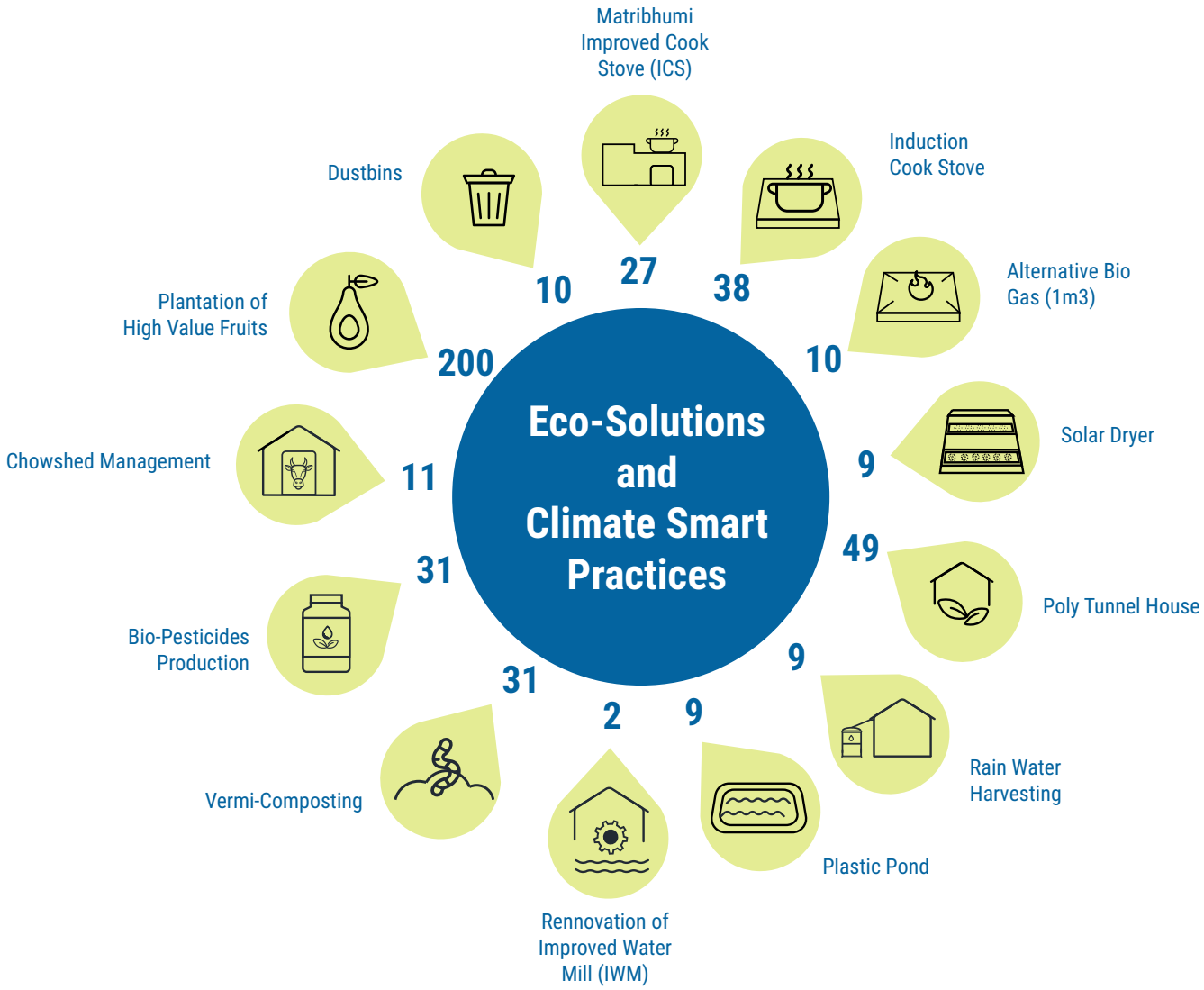
When the project arrived in her village, she was curious to know if there was any assistance and support for family like hers who were practicing animal husbandry. Upon discussion, the project team found that she had been facing problems in maintaining hygiene in her cowshed. Moreover, the livestock waste was such that it was affecting overall sanitation of her household. The cattle urine used to get soaked by the bedding materials, in the shed. It was a tough job to clean the shed with the completely drenched heavy bedding materials.

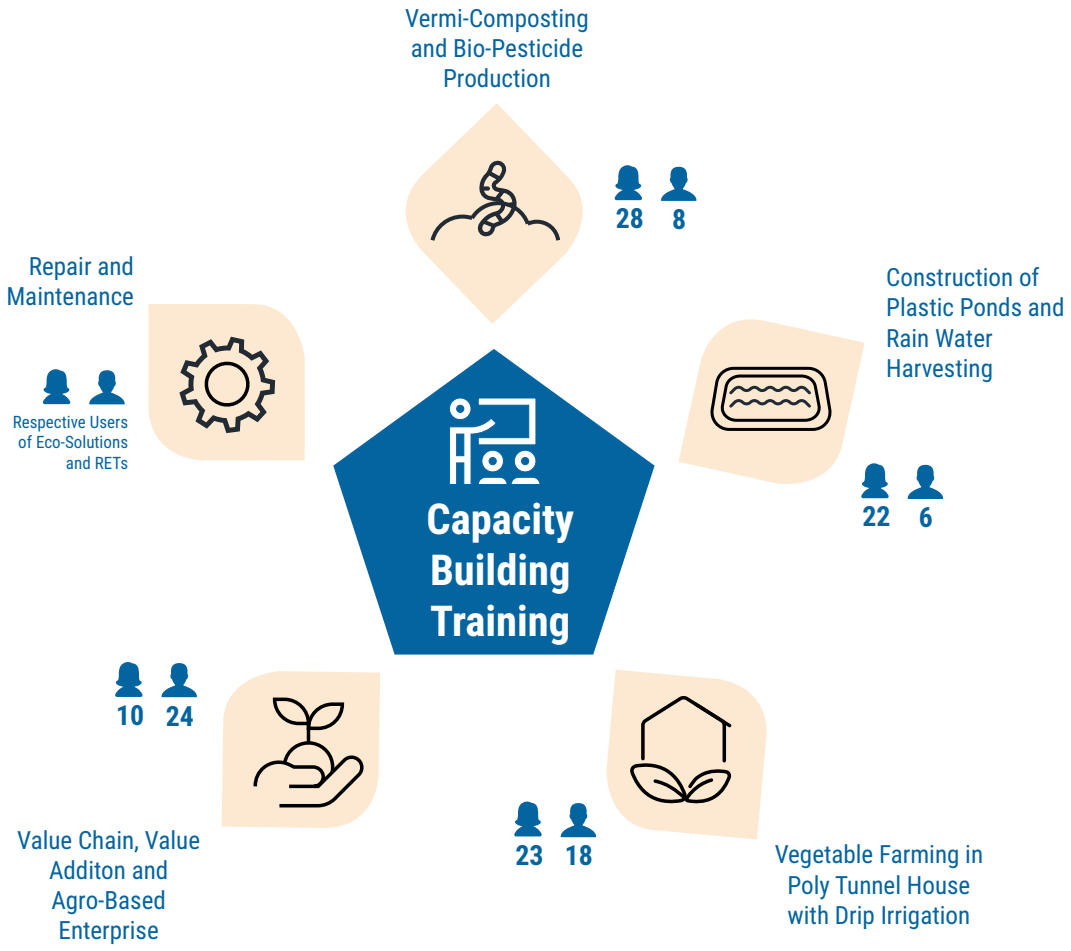
She has greatly benefited from the improved cowshed which was a result of adopting cowshed management techniques that she learned from the project. After getting knowledge, she and her husband improved the shed by concreting the floor with a sloping angle to facilitate cleaning and collection of waste, constructing a gutter to drain and collect the urine in a tank built outside her shed and constructing a designated feeding space, avoiding littering of the fodders. The labor involved in building was contributed by her husband. Kanchi Maya said, *"Previously, it was very difficult to clean and collect the urine as it would splash and get soaked on the fodders and the shed was too filthy, but now the urine can easily pass through the drainage pipe and gets collected in the cement tank constructed outside my shed which can then be used in my farmland. Likewise, the littering of the fodder has also been avoided by construction of designated space for feeding my cattle. Overall, by improving my shed, my drudgery has been reduced and I am now able to use waste, especially urine in my farmland which is an additional benefit of improving my shed".* In a day, on an average, approx. 25 liters of urine gets collected from a buffalo and a cow in the collection tank which has been made out of cement mortar.



Climate Smart Practices in Numbers*

** Households*





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