Land shaping/ Ail (Bund) cultivation

In the coastal zone of West Bengal, crop cultivation comes to standstill due to inundation of rain water. To overcome this problem, land embankment was raised up to one meter keeping the low land paddy field aside. The width of the embankment was made 90 cm whereas the base remained 150 cm. To make a raised land embankment along the circumference of 1 ha land, having 400 running meter, 480 cubic meter soil was required which was collected by making trench or digging small pond of about 24 meter long, 10 meter width and 2 meter depth within the paddy field itself. When considering the quantifiable impact in terms of returns to investments, water is being harvested for irrigating vegetables grown in the embankment of paddy field. Paddy-cum-pisciculture is being practiced in the excavated pond. Such structure remains erect up to 8-10 years without incurring additional expenditure by the farmers. Vegetable cultivation throughout the year is possible in this shape of land. The technology has become very popular in manydistricts of West Bengal.



Sand Bag Check dam (Bora Bandi)

As a result of climatic vulnerability, many districts of Jharkhand state suffer from erratic and insufficient rainfall throughout the year leading to chronic shortage of water in the rivers/ streams. Earlier, pakka check dam was constructed on rivers but that dam used to be damaged after one year, and the dams became of no use. Due to slope, water could not be stored. After creation of low cost temporary structure through sand bag on river of 50 meter length, huge quantity of water can bestored for supplemental and drinking purposes. Recharging of well in nearby of the village has become an additional advantage. Side by side, water table of the surrounding areas has risen by 44% followed by an expansion of area under off-season vegetable cultivation in 10.0 ha, summer paddy cultivation in 10.0 ha, wheat cultivation in 50.0 ha and safe harvesting of standing paddy from 30.0 ha during

acute scarcity of rainwater. Mono-cropping has turned into double and in some cases multiple cropping in the village. Around 75 check dams werecreated during last three years in Gumla district of Jharkhand. This technology is being rapidly adopted by the people of other surrounding districts in Jharkhand state.



Low cost nutritional weaning food: A case of up-scaled technology

Malnourishment amongst the pre-school children (0-5yrs age group) in Uttar Dinajpur district was alarming. As data revealed from District Project Office, ICDS, Uttar Dinajpur that around 10 percent children enrolled with 3737 numbers of Anganwari centres of the district were severely underweight and defined as *"Red-Children"*. The Integrated Child Development Service (ICDS), Uttar Dinajpur was providing various services through 3737 service centres. Keeping this alarming situation in view and considering the poor economic condition of a large section of community, Uttar Dinajpur KVK since its inception has taken rigorous activities for protocol development of various low cost nutritious weaning food utilizing locally available ingredients (wheat, maize buck wheat, green gram, peanut, drumstick leaves etc.) through its mandated activities of on farm trials (OFTs). After rigorous trials for several years, Uttar Dinajpur KVK has been able to develop and standardize several formulations of low cost weaning foods. The calorie measurement and nutritive value of the feed formulations has been tested at CFTRI, Mysore. All the feed formulations passed the criteria on calorie measurement and nutritive value as per national standards.

After standardization of feed formulation through On Farm Trials Uttar Dinajpur KVK started wide scale adoption of the technology through training of the SHG members and Anganwari workers for capacity building and sensitization, frontline demonstrations, case studies, awareness campaigns, field days etc. Three SHGs after getting trained from KVK, started producing low cost weaning food under direct supervision of KVK and selling it in the name of 'SHISHU AAHAR' in the local Mela, rural Haats, Krishi Mela, Swanirbhar Mela, Kanyashree Mela, Sabala Mela etc. As a result, the brand name of 'SHISHU AAHAR' got a wide spread popularity and preference amongst the resource poor farm families. Then, Uttar Dinajpur District Administration decided to incorporate the low cost nutritious weaning food developed by Uttar Dinajpur KVK in a project called "PUSHTI"– an initiative for providing additional nutritional supplements to the malnourished pre-school children through SHG networks of the district. Skill development training on preparation and quality control was imparted to the selected SHG members by the KVK. The DRDC was in need to

supply 3007 packets of food supplement for the children and 2054 packets for the pregnant mothers in the district per week and DRDC negotiated the matter with 10 SHGs one each from ICDS block of the district to produce and supply required numbers of food packets to the concerned ICDS centre of the block. On the other hand, DRDC remitted the fund for the cost of the food packets in the account of the concerned SHGs. The process has been established and running smoothly since October, 2014 to combat malnourishment among children and pregnant mothers. The positive impact of the food supplements provided to the malnourished children can be revealed from the chart. Figure shows month wise data on severely malnourished children in Uttar Dinajpur District after supplementing with low cost weaning food developed by KVK.



Though "*PUSHTI*" project is operating in the whole district, now, Uttar Dinajpur KVK is working particularly on tribal children to eradicate malnutrition through FLD programme. The details are given in the following table.

Sl. No.	Name of Village	No. of children	Adoption rate of technology
1.	Dhuliagacch	16	65%
2.	Gulamigacch	18	58%
3.	JhitkaTutikata	23	45%
4.	Kadamtala	14	72%
5.	Dhonogacch	21	75%



Vermicompost: An additional source of income

Sk. Abdul Hanif, of Village-Konnamoni, P.O.-Sarenga, District- Howrah, West Bengal, used to cultivate paddy in 0.5 acre land, and banana and vegetables in 0.36 acre land. In addition, he used to cultivate his upland (10 katha) for the consumption of his family i.e. his wife and seven children. But, it was very difficult to meet out all family needs from his small earnings. Earlier, he used to work in a jute mill which remained closed for two months in a year due to lock out. As his agriculture productivity was also decreasing and cost of cultivation was increasing, he went to meet ADO of his block for advices who told him to construct vermicompost unit in his land. But, due to financial problem, he could not start. After that, he participated in many capacity building programmes on vermicomposting and learned about benefits, uses, composition and preparation of processes. He planned to compost organic wastes i.e. cow dung, green leaves, skin of vegetables, trunks of banana trees, water hyacinths etc. available with him. With the financial help of Ambuja Cement Foundation, Mr. Hanif started vermicomposting at one corner of his upland field using good quality tarpaulin in the pit. The pit was 10 ft long and 3.5 ft width. At a time one ton of vermicompost materials could be produced from his pit. At initial stage, he purchased 2000 number vermin worms at the cost of Rs. 500/- and also constructed a shade over the pit to protect compost from rain and sun. He produced 5 tons of compost and earned a net profit of Rs. 16000/- from that produce. In next year, from 9 tonnes the earning was Rs. 25000/-. Ultimately, his production reached at the level of 15 tonnes/annum and it has become a very good source of income of Mr. Hanif. Now-a-days, the vermicompost production has become very popular in the district as farmers are routinely used in field of paddy, banana and vegetable cultivations.



Developing successful social network based online marketing systems for various agricultural produces during COVID-19 lockdown

Coochbehar district is characterised by the dominance of marginal farmers with very low and fragmented land holdings. The district holds a significant position in steady production of variety of vegetables round the year. During last few years, the vegetable growers faced hardship of distress selling due to ill managed and tiring middleman dominated marketing system. Sometimes, they faced around 30-40% post-harvest losses of perishable commodities. In spite of all those bottlenecks, vegetable cultivation had been the mainstay of life sustenance and earning livelihood of a sizable number of farmers in the district. But, the situations become pathetic in the wake of COVID-19 pandemics and subsequent lockdown situations since end of March, 2020. The farmers of Coochbehar district started facing problem of marketing vegetable, cereals, pulses and fruit crops during lockdown period due to stand stillness of public transport system and absence of any mechanism to make agricultural products available to the markets. Local markets started experiencing shortage of availability of vegetables. Bihar, Uttar Pradesh, Punjab, Bhutan and North Eastern states are the major consumers of vegetables from Coochbehar and Jalpaiguri. But, due to lockdown, the famers failed to market and send their produces in those areas. Fresh green vegetables like pointed gourd, bitter gourd, brinjal, chilli, cucumber, ridge gourd, late cauliflower, late cabbage, tomato, water melon, leafy vegetables and the prized local banana landrace the *Malbhog* started getting over matured and got rotten in the field itself. Phone calls and *WhatsApp* picture from the distressed farmers flooded the inbox of Coochbehar KVK.



At that juncture, Coochbehar KVK, West Bengal and the newly formed Startup-Kisankarts Agro Management Private Limited registered under the umbrella of 'Startup India' of Govt. of India with knowledge partnership of Coochbehar KVK jointly develop artificial intelligence (AI) enabled smart farm management portal and an online farm to home delivery model of fresh vegetables, fruits and others food grains during the lockdown period. The main objective was to develop an effective supply chain network for ensuring on-demand supply of agricultural produce at the doorsteps of the consumers vis-a-vis helping the growers to get remunerative price out of their field produces at the time of distress. The KVK acted as knowledge partner and Start-up Company provided the material technology as applicable. In primary stage, the beneficiary farmers was selected from adopted villages under Coochbehar KVK of UBKV. The company offered to make the farmers aware of the storage solution through product demonstration and information dissemination, getting the consumers on the platform to buy farmers' produce and arranging all logistic support to transport the farm produce to the doorstep of the consumers in a B2B, B2C and C2C type of agri e-commerce marketplace named as KISANKARTS.COM using social networking sites (Facebook, WhatsApp, YouTube) and phone call for online delivery of vegetables and fruits to the locked down people of Coochbehar.

The portal is used for distance marketing of agriculture produces along with equipment, pesticides and insurance too. It gives a platform to the suppliers and

manufacturers to showcase their products and sell them without the intervention of any middlemen. Apart from online and digital presence, this Startup has also a strong offline network at village panchayat level to provide 24x7 hand holding assistance to the farmers. Since inception of this experimental extension model on April 9, 2020 Kisankarts Agro Management Private Limited procured green vegetables (05 t), watermelon (90 t), wheat (25 t), pulses (10 t), potato (70 t) and has paid an amount of Rs. 25.91 lakh to the farmers of the KVK adopted villages of Coochbehar district within a period of two weeks' time (9/4/2020 to 23/4/2020). Moreover, the startup procured field crops (in advance) like lentil (100 mt) worth of Rs. 53.5 lakh and maize (1000 mt) worth of Rs. 1.35 crore from the farmers of Coochbehar district. The experimental extension model of developing value chain social networking system, farmers cooperation and collective action created some positive research insights which can effectively be replicated to some competent and potential Farmers Producers Companies of the district for scaling up such marketing model for enabling them stepping into the marketing domain of post-harvest segment of Indian agriculture. This initiative can pave the way of long cherished objective of doubling farmers income through getting rid of them from ill managed and tiring middleman dominated marketing systems and fetching remunerative price by the farmers from their agricultural produces.

Value chain management for sustainable vegetable marketing during COVID-19 Pandemic situations

During COVID-19 pandemic, vegetable price and demand both were very low at Sonamukhi, Bankura local market. Whereas, at the nearby metro city i.e. Kolkata, the vegetable the prices were quite higher. At that time, WBCADC and KVK Bankura, Sonamukhi came up with a marketing channel approach where the main objective was to abolish middle man activity. The WBCADC and KVK Bankura jointly conducted the activity where they collected vegetables from SHGs on weekly basis and sold at Kolkata. In this value chain management, *'Dihipara Monalisa Mahila Swanirvar Dal'*, a SHG of Sonamukhi Block, Bankura involved actively. The group members of the SHG received different improved vegetables seeds and seedlings from WBCADC KVK Bankura along with various skill development trainings on nutritional garden, *Nutri Thali* and organic farming. That facilitated production of a variety of fresh vegetables on farm and subsequent marketing. Both the organizations provided refrigerator insulated *ToTo* rickshaw to the SHG so that they could supply fresh product at consumer door steps and abolish the middlemen.

This value chain marketing management enabled the farmers to get reasonable prices of their vegetables. According to the SHG members, the price of the vegetables provided by the institutions was much higher than the local markets. In that way, the SHG members earned a handsome income and did not have to face the difficulty of storing perishable product and losses. '*Dihipara Monalisa Mahila Swanirvar Dal*' of Sonamukhi has set an example of the well said proverb-'*If there is will there is way*'. This is one kind of supply driven approach too. Because, when the market and remunerative price both are assured, automatically the production gets a hike in quantity as well as quality. This kind of produce-market driven approach motivates the farmer to form FPO and FPC. This value chain marketing system becomes a model for organized marketing of vegetables not only in Bankura district but also in South Bengal areas.



Enhancing tribal farmers' income through agricultural technology interventions at Nicobar Islands

The KVK Nicobar adopted Nicobari tribal farmers who were practicing traditional *Tuhet* system of subsistence farming. The KVK scientists guided them with technological know-how and do-how of vegetable cultivation. We all know that at Nicobar Islands, the availability of agricultural land is very limited. However, in a span of last four years, the farmers have brought 4550 m² of his hitherto fallow land of 2 ha under vegetable cultivation. By incorporating 8 to 15 vegetable crops, the diversification index of the farm increased from 0.58 to 0.77. Even as the acreage under high value vegetables increased, the farmers simultaneously accommodated other crops in minor proportions to tide over production and marketing risks. Thus, through area expansion, technological adoption, diversified cropping pattern, efficient resource management and tactical marketing, the farmers' gross income has increased 5.5 times from Rs.93561/- to Rs.515935/- while the net income has increased almost 12 times from Rs.936711/- to Rs.428872/-. Therefore, it is imperative to support the earnest efforts of tribal farmers to increase the vegetable production at the Islands by lending necessary Institutional supports. Now-a-days, wherever possible, farmers are preparing land for vegetable cultivation.



Roof top rainwater harvesting for drinking water and domestic use at costal saline zone

Under Swachh Bharat Mission, KVK S 24 Parganas (Nimpith) demonstrated around 63 units of rainwater harvesting structures in 3 villages at their costal saline zone to ensure water for drinking and other domestic uses. It was found that the stored rainwater was potable and much better in quality than the traditional sources. The women members of the beneficiary families could get a relief from their daily drudgeries of travelling long distances in search of potable water during winter and summer season. This pure drinking water source proved to be highly indispensable during and after cyclonic disturbances like '*Bulbul*' and '*Amphan*' in the region. The adoption of roof top rainwater harvesting system ensured a step forward towards a healthy and hygienic society in the Sundarban villages where ground water level is dwindling day by day.

