



## Innovative Extension Approaches for Increasing Income of Rice Farmers

**SK Mishra, Lipi Das, GAK Kumar, NC Rath, B Mondal, NN Jambhulkar, P Samal, BN Sadangi, SK Pradhan, S Saha, PC Rath, AK Mukherjee, RK Sahu, PK Guru, CV Singh, SM Prasad, S Bhagat, S Roy, R Bhagabati and K Saikia**

### SUMMARY

Social research on development and experimentation with new extension approaches and models for faster dissemination of latest technologies and their wider adoption has got more significance after Green Revolution during late 1960s in India. These approaches vary widely from top-down and supply-led to bottom-up, demand-led and participatory, mostly due to diverse agro-climatic regions, socio-economic conditions and types of stakeholders. The ICAR-NRRI has been experimenting with such five innovative extension approaches relating to (i) rice varietal popularization, (ii) sustainable local seed system, (iii) rice value chain, (iv) gender sensitive extension and (v) rice-based climate smart model village approach. The rice varietal popularization strategy aims at shortening the time gap between the development of a new higher yielding superior variety and its wide adoption by farmers. This would also help in substitution of old mega varieties susceptible to various pests and diseases with superior and multiple stress tolerant varieties in view of changing climate scenario. The 4S4R model of local seed system has attempted to improve the local seed system of villages through formation of farmer producer organizations (FPOs)/farmer interest groups (FIGs) and capacity building of farmers in quality seed production of their locally demanded varieties, in right time and at lower cost. This self-sufficient sustainable seed system would help to address the various acknowledged demerits of the public seed system. The rice value chain model developed through an MOU of stakeholders from rice breeder to consumer would ensure rice growers to get fair price of their produce, while benefiting all stakeholders and satisfying the consumers. The gender sensitive extension approach in a rice-based farming system would help in proper utilization of latent capacities of farm women and grooming them to lead agrarian economy at par with their male counterparts. This approach would also help to change the traditional mindset of the male-dominated society and create a healthy societal climate boosting rural economic growth. The access to technologies and productive resources by farmwomen has increased remarkably in our study area. The rice-based climate smart model village approach through coordination and convergence of all development departments alongside the farming communities has helped to bring all stakeholders to a single platform for holistic planning of villages, execution of action plans, monitoring of interventions and immediate remedial measures. This approach would help to mobilize the farmers, farmwomen and rural youths, while addressing issues relating to livelihoods, youth unemployment, market linkage and changing climate.

## 1. INTRODUCTION

Development of new approaches in agricultural extension in India and worldwide is a continuous process with its focus on increasing productivity and profitability. Since the Green Revolution during late 1960s, Indian agricultural extension has adopted decentralized, participatory and demand-driven approaches, in which accountability is geared toward the users (Kokate et al. 2009; Sulaiman and Hall 2008; Swanson 2009). While the call for demand-driven agricultural extension has existed for several decades now, new modes of reaching out to farmers could have significant impact in India, as they might better reflect the local information needs of farming communities. The diverse nature of the Indian subcontinent, with its wide variety of agro-climatic regions and broad range of socio-economic conditions in the rural population, calls for agricultural extension approaches that are context-specific and situation-specific. Extension organizations in general have been using a wide range of methods for reaching individuals, groups and the wider public in rural areas with new information/knowledge. Approaches to extension also vary widely from top-down and supply-led to bottom-up, demand-led and participatory. Approaches also vary depending on the mandate of the organization or the programme. Advances in information and communication technologies (ICTs) have also provided new opportunities for extension to reach more farmers in a short amount of time (Sulaiman et al. 2011). Five such innovative extension approaches pertaining to (a) rice varietal popularization, (b) sustainable local seed system, (c) rice value chain, (d) gender sensitive extension and (e) rice-based climate smart model village approaches have been covered in this chapter. Efforts have been made through the chapter to address various issues and problems responsible for low income of farmers and share innovative ways, means and extension solutions to get rid of those problems. The new ideas could be suitably blended with existing extension models to hasten the extension service delivery in any developing nations. The authors are of strong opinion that the information on innovative extension approaches would be very useful to researchers, policy makers, academicians, development professionals, agro-processing industries, scholars and farmers at large.

## 2. CONSTRAINTS OF TECHNOLOGY TRANSFER AND ADOPTION

The varietal development effort of the ICAR-NRRI has got an impetus in recent past with an average of about six varieties per year (Table 1). But most of these varieties are neither in state seed chain nor adopted by farmers due to their unawareness or any other reason.

**Table 1. No. of rice varieties developed by ICAR-NRRI since its inception.**

Period	No. of years	No. of variety developed	Average no. of variety developed per year
1946-2000	54	57	1.05
2001-2010	10	28	2.80
2011-2017	7	40	5.71
Total	71	125	1.76



A critical review of past studies reveals that the major reasons for slow spread and adoption of new varieties by farmers pertain to (i) non-inclusion of recent varieties in state seed chains, (ii) non-receipt of breeder seed indents from the state agriculture departments, (iii) lack of sufficient quantity of quality seeds, (iv) lack of publicity and awareness among farmers and extension personnel, (v) insufficient minikit trials and demonstration programmes, (vi) lack of effort by central and state extension machineries, (vii) absence of suitable seed production and distribution policy etc. It is seen that a new rice variety takes about 6-8 years to be known or popular by the farmers. But as per the existing government policy, all the subsidies cease for any variety which is older than 10 years and those cannot be promoted through any scheme with exception in case to case basis. To overcome this problem, the institute has intensified its effort to fast spread and popularize newly released varieties in various states through front line demonstrations and other transfer of technologies methods with the active participation of various stakeholders.

As per the feedback information collected by this Institute from the rice growers of our country, unavailability of quality seeds in sufficient quantity and in right time is their most pressing problem. The formal system of seed production in India has been fulfilling the need of the farmers. However, the system faces a number of problems related to quality, quantity, timeliness, choice of variety, cost of seed production and distribution. The solution lies in developing suitable local seed systems. In contrast to formal seed sector, local seed system, if strengthened, can offer solutions to overcome the constraints of formal (government) seed supply system. Local seed system can produce seed according to local farmers' need, in right quantity, of right quality, with lower cost of production and supply and with timely delivery of seed to farmers. Therefore, this institute has developed a self-sustaining local seed system model, which needs to be validated before being replicated and adopted in a large scale. This will help in accelerating the varietal replacement rate (VRR) as well as seed replacement rate (SRR) in rice.

One of the major concerns of farmers is the absence of lack of proper marketing facilities in almost all the states. Farmers are deprived of getting their minimum support price (MSP) and are forced to sell at distressed price (less than 2/3<sup>rd</sup> of the MSP) to the middlemen. To ensure fair price of their produce and maximize rice farmers' income and net profit, the ICAR-NRRI has been working on developing and refining a multi stakeholders' rice value chain (RVC) approach since 2014-15. Among the various approaches to increase farm income and promote entrepreneurship, the prospect of rice value chain assumes importance in agriculture and allied sectors (Das 2017). The RVC, besides having the fundamental benefits, has some added prospective like (i) rice will continue to dominate the farm production for various socio-economic and cultural reasons in spite of poor financial gains and market glut, (ii) demand in the national and international market for quality rice is quite apparent, (iii) apart from farmers, other stake holders can join the chain leading to creation of additional employment and (iv) quality and specialty rice varieties developed by research institutes can spread quickly with less investment in extension.

Gender issues in rice farming have always been a much talked topic of discussion. Rice production is a labour-intensive activity, which involves both male and female members. In eastern India, farmwomen perform up to eighty per cent of the work in rice fields and are involved in almost all activities of rice farming. However, they are often marginalized in business relations and have minimal control over access to factors of production like land, inputs such as seed and fertilizer, credit and technology. So, the question remains how to empower farm women, when the available statistics speak volume of their poor condition worldwide. It is reported that unlike farmers, only five per cent of current agricultural extension efforts and resources are directed to farmwomen. Secondly, India is a country of continental size with a population of over 1270 million, out of which about one third live in urban areas. Ready-to-eat processed and packaged foods have become necessity and popular among this huge urban population in recent years. Therefore, the Indian food processing industries including rice is being termed as a 'sun-rise industries' and several efforts have been made in the last few years to give a big thrust to this sector. The food processing sector plays an important role in improving agricultural productivity, reducing post-harvest losses, providing better nutrition, creating huge employment opportunities and in improving food availability for the domestic market. Looking at the inherent skills and expertise of Indian women in preparation of traditional rice based value added products, we need to harness this vast pool of knowledge and skill, and translate them into a commercial venture providing livelihood security, food and nutritional security, and contributing to national economy. Therefore, we should focus on some of these issues and strategies for commercialization of such rice based processed value added products (VAPs) in an entrepreneurial mode and linking them to the food value chain the country.

Several agencies are working for developing rural areas and village people. The development takes place on the basis of quantum of efforts of agencies in their respective areas of jurisdiction. The development is not always uniform. Piecemeal approach, sporadic efforts and casual attitudes of development agencies often lead to skewed growth and development. The visibility of efforts tends to disappear slowly or fast depending upon the magnitude and quality of work, once the change agents/development professionals withdraw their involvement. When different agencies work independently in different directions in meeting the aspirations and expectations of the village people, the focus of attaining sustainable rural development is lost. This results in uneven development. Hence, this calls for an integrated extension approach involving different stakeholders in ensuring holistic development of villages. This can also lead to development of model villages where progressive agriculture and empowered village society would be witnessed. Developing a rice-based climate smart model village through convergence of all stakeholders namely, researchers, development personnel, farmers, farm women, youths, farmers' organizations and NGOs etc is another innovative extension approach for inclusive development of all available local resources in an integrated manner.

### 3. STATUS OF RESEARCH

Regarding adoption of rice varieties in Bangladesh, Hossain (2012) reported that the number of varieties grown in different seasons were 1091 (Aman/Kharif-535, Boro/Summer-261 and Aus/Autumn-295). However, only a few varieties covered a large proportion of area. The major varieties according to area coverage in Bangladesh were BRRI Dhan 29 (37%) and BRRI Dhan 28 (23%) in dry season, while BR 11 (27%) and Swarna (12%) in wet season. Similarly, the survey report also encompasses findings from three major rice growing eastern Indian states namely, West Bengal, Odisha and Jharkhand. The survey identified 226 rice varieties in West Bengal, a large proportion of which were traditional varieties mostly grown in the aman season. The most popular variety in the aman season was found to be Swarna (45% of the rice area), whereas in the boro season it was IR 36 (27% area). The main source of seed for aman varieties was farmers' own seed, whereas, in the case of improved boro varieties, it was seed traders. In case of Odisha, the number of varieties identified in the wet season was 723, most of which were traditional varieties. On the other hand, the number of varieties in the summer season was 29, all of which were improved varieties grown under irrigated conditions. Variety Swarna (29.3%) was the most popular variety in the wet season, whereas in summer it was Lalat (47.0%). In Jharkhand, altogether, 145 varieties were identified and the highest number was for medium land (71), followed by lowland (55) and highland (19). In the highland, traditional variety Gora Dhan was found to be the most popular, while in the medium land and lowland, improved varieties namely IR 36 and Swarna respectively, were the most popular varieties.

Regarding primary traits for farmers' varietal preferences, he reported that farmers sought high grain yield from limited farm size as the most important trait in a new variety. The responses of the farmers from Bangladesh, West Bengal, Odisha and Jharkhand with respect to this higher grain yield trait were 96%, 100%, 100% and 73% respectively. Farmers also looked for secondary traits like grain quality for a premium price in the market, shorter maturity duration, lodging resistance, and higher milling recovery.

The survey on adoption and diffusion of new varieties in Bangladesh, West Bengal, Orissa and Jharkhand revealed that (i) If varietal performance is substantially better than that of existing varieties, large farmers adopt and small and medium farmers follow, otherwise, the variety is eliminated, (ii) Availability of seed of improved varieties is a major constraint for fast-tracking diffusion (70% to 80% of the seeds are from farmers' own harvest or are exchanged with or purchased from neighbors), (iii) Once farmers in a village are convinced of the superiority of a new variety, it takes 3 to 5 years to reach areas suitable for the variety, (iv) However, it may take a longer time to reach a substantial portion of area because of information lag (extension system is not highly effective, radio/television is a minor source of information, input dealers are not targeted as information bearers), and (v) Once a variety is established, it is difficult to dislodge it, unless new improved varieties have traits that are substantially superior.



For realizing optimum productivity of any crop in any production environment, the choice of an appropriate variety is extremely essential (Lal 2010). He added that the variety to be selected for cultivation must be adapted to the specific agro-ecologies/production environments. Improper choice of the variety would result in low productivity, even when adequate quantities of inputs are applied. It is equally important to use the latest recommended varieties, since all varieties tend to lose disease resistance on account of evolution of pathotypes/ biotypes of the disease.

For promoting newly released varieties, ICAR-NRRI has been producing breeder seeds of rice as per seasonal indents received from various states through the Department of Agriculture & Cooperation, Government of India and various other organizations. In addition, truthfully labeled (TL) seeds are produced in the research farm as well as in farmers' field in a 'Farmer Participatory and Buy-back mode' for direct sale to farmers through its own sale counter. In addition, limited varietal demonstrations are conducted in selected clusters in the Odisha state. As part of the varietal development programme, all India coordinated research project (AICRP) trials are conducted in various states to test the efficacy and adaptability of the varieties. Apart from these, minikit trials are conducted through various research initiatives like institutional research projects, externally aided projects, and various programmes like, Tribal Sub-Plan (TSP), Mera Gaon Mera Gaurav (MGMG), Farmer FIRST, BGREI, NFSM, NICRA, KVKs etc to demonstrate and promote new varieties. The institute also organizes and participates in national and international exhibitions showcasing its latest varieties and rice production technologies. All trainee farmers and important stakeholders coming from various states are also provided with seed minikits for their respective local demonstrations and spread.

Paroda (2010) opined that for achieving desirable levels of seed replacement rate (SRR), adequate seed needs to be produced first. Seed production programme should be organized in each state under a comprehensive and integrated state seed plan appropriate to region specific requirements. States should ensure production, multiplication and replacement of seed and varieties to increase seed multiplication ratio (SMR), seed replacement ratio (SRR) and variety replacement ratio (VRR) progressively, particularly in respect of regionally important crops/varieties. While delivering a special lecture during Indian Seed Congress 2013, Paroda (2013) mentioned that promotion of hybrids/ HYVs in major field crops should be a high priority to bridge the productivity gap and increase production. In this context, the private sector has to play a major role. Immediate action is warranted for phasing out of all old and obsolete varieties through de-notification and promoting only the best varieties and hybrids suitable for specific regions, irrespective of whether they are from public or private sector.

Sharma et al. (2013) stated that the present supply chain structure of rice in India works on the traditional framework, which involves many intermediaries at supply and distribution fronts. The current supply chain structure of rice in India is somewhere lacking in efficiency and needs reforms. The traditional supply chain structure faces the problems of inventory management, where either there is the



overstocking which results in obsolescence and increased supply chain costs, or the stock outs of the demanded varieties resulting in lost sales. Supply chain of rice in India is also facing the supply chain problems related to procurement, distribution, intermediaries collaboration, and logistics system which needs to be redesigned. In spite of being the second largest producer in the world and a big consumer of rice, which holds a significant presence in the global agri-food market, India fails to contribute to the global food business to the level it deserves.

While analyzing value chain of rice and wheat in Uttar Pradesh state of India, McCarthy (2008) viewed that high local, global and regional demand for rice and wheat could greatly benefit smallholder farmers of both of these staple crops in the rural areas of India. Small landholders, the major engines of production in India, can take advantage of these growth trends to meet this demand and increase their incomes. Taking advantage of these parallel trends will require farmers to increase production, reduce post-harvest losses and market their crops in new ways. Amendments to the restrictive state marketing channel (through mandis, or wholesale markets) are beginning to allow farmers to access more profitable channels for their produce. The mandi system does not reward farmers for higher-quality produce as alternative market channels would, such as direct supply to supermarkets by establishing value chain. The major actors in the rice and wheat value chains are input suppliers (including manufacturers, wholesalers and retailers); producers; a large number of intermediaries (including collectors, traders, commission agents, and brokers); wholesalers; processors (including rice and flour millers); and retailers.

There is a growing body of evidence that promoting women's rights over land and natural resources are keys to enhancing women's livelihood security and promoting women's empowerment. Land ownership is likely to have positive effects on agricultural productivity, food security and children's education (Agarwal 2003). Moreover, technology research and innovations are rarely focused on women's specific needs and roles. As a result, farm women generally lack access to improved technologies for use in farming activities, and the large majority of them still rely on traditional, labour-intensive, drudgery-prone and time-consuming technologies. In many countries, the menu of options available to farmers has become more diversified. For instance, in Ethiopia the creation of a 'women's development package' indicates that agricultural officials are trying to improve their services to women (Tewodaj et al. 2009).

The ICAR-NRRI, which has been mandated to increase production and productivity of rice-based farming systems in India, took up a project on 'Gender Mainstreaming in Rice' during 12<sup>th</sup> plan period (2012-2017). A socially acceptable, practicable and replicable approach was conceptualized based on the hypothesis that, 'if the inherent capacity of the farm women are explored and built up through sensitization, gender gap identification, awareness, training, exposure to technologies, access to family resources, group mobilization alongside the male counterparts of the society and necessary organizational support, then all round development of the farm women and household agricultural production and productivity can be achieved'.



Under this approach, intense gender sensitization was a pre-requisite, which followed capacity building programmes of women rice growers. Both men and women get equal opportunity to exchange their experiences and feelings to provide community support to women rice growers in many critical areas of gender gap. Finally the approach ends in leaving the women in the family and evaluating the overall household improvement in rice production and productivity in particular and gender issues in general. The major activities, outputs, outcomes and experiences have been discussed below under the approaches section.

## 4. KNOWLEDGE GAPS

Results of on-station, off-station and on-farm demonstrations, minikit trials and farmers feedback on the institute developed varietal performance and their superiority over local popular checks have been very encouraging over the years. Despite all above efforts by the institute, varieties are spreading slowly and not reaching a wider population as desired. One of the major shortcomings of the institute is production of limited quantity of seed due to availability of limited area of about 30-40 hectares land for seed production. On the contrary, state agricultural universities have been well-placed due to their huge network of regional research stations within respective states with vast area under seed production plan. Apart from superiority of varieties, availability of large amount of quality seeds (foundation and certified seeds) is equally essential to fulfill the seed requirements of state machineries to promote through seed chains. Because of this reason, ANGRAU model of rice varietal diffusion and popularization through distribution of sufficient minikits during initial 2-3 years of their development has been a very successful model, as was shared by two of its former Breeders-cum-Vice Chancellors namely, Prof. P. Raghava Reddy and Prof. Padma Raju during the national level Brainstorming Workshop on “Rice Varietal Diffusion: Estimation, Problems and Prospects” organized by MANAGE at Hyderabad during 19-20 May, 2017, citing examples of mega varieties like Swarna (MTU-7029), MTU-1010, MTU-1001 and Samba Mahsuri (BPT-5204).

Another grey area is, farmers are not getting quality seeds in time at their door step, even though rice seed market is growing faster in recent years. Rice seed production and marketing is a very good enterprise in itself. Still, many Indian states are facing very acute shortage of rice seeds with very less VRR and SRR. Rice seed production technology and marketing can easily be promoted and adaptable, but requires proper technical backstopping and active participation of farmers’ organizations. There is hardly any research or extension or organizational efforts to make rice farmers self-sufficient with quality seeds at local level. Similarly, this institute has developed some high protein, aromatic, export quality long slender and superfine grain varieties, which can fetch higher remunerative market prices, benefitting the rice growers. Developing and refining a multi-stake holder’s rice value chain (RVC), involving all players starting from the rice developer to the consumer, can be a unique and innovative proposition for this.



Indian farmwomen play a more significant role in rice sector contributing to substantial increase in family income. They are traditionally skilled to prepare thousands of value-added food products, so also rice based products. Encasing their skills and involving in rice based value added enterprises and linking them to the market can be a successful research endeavour. But, no such visible steps have been taken so far at any level.

## 5. RESEARCH AND DEVELOPMENT NEEDS

In this section, various processes involved and experiences learnt in all the five innovative extension approaches of NRRI, Cuttack have been discussed.

### 5.1. Approach-I: Rice varietal popularization strategy

The Institute is working on developing mechanisms to shorten the period between varietal development and varietal spread leading to wide adoption, which can be simplified in following concurrent activities. First of all, we need to identify existing popular varieties and farmers' preference in selected states for testing new and comparable improved varieties through collection of primary as well as secondary data from targeted areas. Accordingly, taking all criteria like ecology, duration and farmers' preference into consideration, a 'Varietal Matrix' can be prepared for all 'popular but lower yielding varieties' *vis-a-vis* 'new, superior and higher yielding varieties' for replacement with better alternatives. Ecology wise district clusters should be selected (may be, any one revenue block close to the district headquarters and adjacent to a primary village road) and selection of about 15-20 innovative farmers per cluster in consultation with state agriculture department officials and other stakeholders. Varietal demonstration should be conducted by providing only 5-10 kg seed minikits as critical inputs without altering farmers' own crop management practices. Planning for demonstration should be done in such a way that all the districts may be covered in a maximum of 2-3 years in rotation.

These small scale on-farm demonstration may be done for participatory varietal evaluation in consultation and collaboration with all stakeholders like, state departments of agriculture (SDAs), state seed corporations (SSCs), state seed certification agencies (SSCAs), farm science centres/ krishi vigyan kendras (KVKs), state agricultural universities (SAUs), regional research institutes, farmer interest groups (FIGs), private seed companies and dealers, non-governmental organizations (NGOs) working in agriculture sector, media representatives and both demonstrating and non-demonstrating farmers. Big size and clearly visible road side field boards should be placed on the demonstration sites with details of varietal characteristics in local language.

Capacity building programmes have to be conducted for various stakeholders through training programmes, package demonstration, technical backstopping through field visits/telephonic advisory/creating mobile social groups and conducting field days at various stages of crop growth, especially in pre-harvesting stage



associated with crop cutting experiments, with the principle of ‘Seeing is Believing’, involving all the stakeholders including non-demonstrating farmers to showcase the superiority of the new varieties. Participating farmers should be encouraged to share their experiences to motivate fellow stakeholders. Best performing new varieties should be upscaled through creating demand for breeder seed indents from next year onwards and promotion of local seed production by government and private agencies for making timely seed availability to farmers, and creating an institutional mechanism for planning and production of adequate quantity of seed for minikit distribution. A nodal officer along with a team of experts may be identified for continuous monitoring at the institute as well as state levels.

Rigorous awareness campaign is required through electronic media, print media, ICT tools like mobile apps/ social groups and distribution of extension leaflets in local languages. Preparing success stories, recording of farmers’ reactions and overall processes documentation are required for publicity and distribution. State level workshops in the initial years must be conducted involving policy makers and senior state development departments, officials to create awareness and convince key players about the superiority of newly developed varieties. The non-conventional channels (like seed companies, rice millers, traders and food processing industries) have to be explored for spread of remunerative varieties. For fast spread of varieties, advisory should be issued to participating farmers for not consuming the produced grains of demonstrated plots during initial years, rather encouraging ‘farmers-to-farmers’ horizontal spread of seeds either through sale or on barter basis for rapid spread. As part of the process, a good document should be prepared encompassing the workshop proceedings, action points, demonstration details, crop cutting data vis-à-vis comparative data on local varietal performance, feedback from farmers and other stakeholders. The document should be widely circulated among important state and central level officials & policy makers and action points should be followed up accordingly.

## ***5.2. Approach-II: Devising a self-sufficient sustainable seed system for rice (4S4R)***

The NRRI developed Self-sufficient Sustainable Seed System for Rice (4S4R) model was conceptualized and developed in 2014-15 and since then it is being implemented, tested and refined in Mahanga block of Cuttack, Odisha. However, the model itself is general in nature harnessing the advantages of advancements in information technology (IT) sector at various stages, like planning, execution, monitoring, capacity building, support and marketing. The model tries to combine best of the technologies and practices available with research institutions, universities and IT institutions. Existing seed system was improved and supported by various innovative interventions as follows.

- Facilitated farmers’ access to seed through (a) Awareness, (b) Training, and (c) Capacity building;
- Introduced appropriate agricultural technologies in (a) Crop production, (b) Integrated pest and disease management, (c) Introduction of improved varieties, and (d) Seed health and storage management;



with Rs. 87.0 lakhs sales realisation. The major challenges faced in implementing this project are coordination among different stakeholders besides setting up FPOs at block level and marketing of the paddy seed.

**5.3. Approach-III: Developing a replicable rice value chain benefiting all stakeholders**

The main objective of the NRRI developed rice value chain (RVC) was to promote large scale cultivation of high quality and specialty rice varieties of this institute in contiguous patches, and to undertake it's processing and trading, so that the consumers have access to premium quality rice and all the parties involved in the value chain are benefitted. During the planning phase of the RVC in 2014-15, several brainstorming sessions, consultations and focused group discussions were held with all stakeholders including state agriculture department to decide the objectives, stakeholders, activities, links, responsibilities of the partners and benefits sharing. Finally, a chain emerged in public-private-partnership (PPP) mode with the involvement for five parties including ICAR-NRRI, Cuttack (Fig. 2). In consultation with all stakeholders, a long slender grain aromatic inbred rice variety 'Geetanjali' developed by NRRI was selected for the rice value chain during the initial year. The responsibilities and benefits for each party were decided and agreed upon (Fig. 3) through a memorandum of understanding (MOU), in brief as follows.

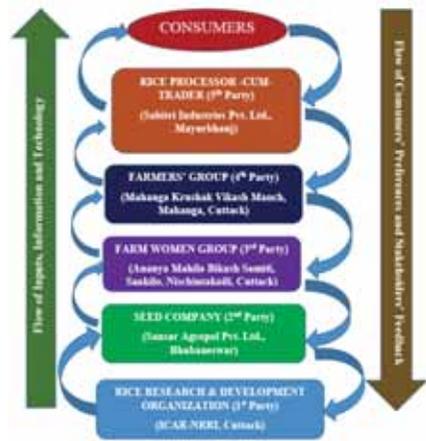


Fig. 2. Schematic representation of the RVC Model of NRRI.



Fig. 3. Functions and Activities of RVC Actors.



- 1<sup>st</sup> Party (ICAR-NRRI, Cuttack): for supplying breeder seeds of ‘Geetanjali’, technical backstopping, capacity building, hand-holding, overall coordination, monitoring, and maintaining season-wise database.
- 2<sup>nd</sup> Party (Sansar Agropol Pvt. Ltd., Bhubaneswar): A seed company for multiplying the foundation or truthfully labeled seeds and supplying seeds to farmers groups/ rice growers at desired destination in time.
- 3<sup>rd</sup> Party (Ananya Mahila Bikash Samiti, Sankilo, Nischintakoili, Cuttack): A farm women group for mobilizing large number of farmers and producing large quantity of grains.
- 4<sup>th</sup> Party (Mahanga Krushak Vikas Manch, Mahanga, Cuttack): A farmers group for mobilizing large number of farmers and producing grains. Apart from production, these farmers groups were also involved to undertake survey of the rice ecology, motivate farmers of various districts of the state to participate in the chain, monitor the production and arrange lifting of production by the rice processor-cum-trader.
- 5<sup>th</sup> Party (Sabitri Industries Pvt. Ltd., Mayurbhanj): Rice processor-cum-trader for procuring grains from farmers’ point immediately after the harvest season ends, at a price of at least 20 percent above the minimum support price (MSP) fixed by the Govt. of India, making payments to growers within ten days of procurement, ensuring quality processing, packaging, labeling with due credit to the variety developer (NRRI) and marketing.

Intensive efforts were made for field monitoring, technical backstopping and capacity building through farmers training, distribution of extension literature in local languages and mobile advisory services through a monitoring committee comprising of multi-disciplinary scientists and state line department officials. Workshops at various stages of the cropping period (pre-kharif, pre-rabi and post-harvest etc) are conducted for deciding varieties, finalizing seed and grain production plan, number of farmers to be involved, recording feedback analysis, sharing experience, and resolving issues with the participation of all stakeholders. As part of our initial effort during rabi 2015-16, grain of Geetanjali variety was produced in three clusters totaling 166 acres of Khurda and Cuttack districts involving 82 farmers. The average yield of the crop was recorded at 4.0-4.5 t/ha. After keeping for seed and household consumption, 202 tons of paddy grains were sold by the participating farmers to the rice processor/ miller (5<sup>th</sup> party) at the rate of Rs. 17,400/- per ton (i.e., 20% above MSP) amounting to a total of Rs. 35.15 lakhs. Similarly, during kharif 2016 and rabi 2016-17, 136 tons of paddy grains were procured by the processor. The economic analysis shows that the participating farmers got an overall net income advantage of about 8-10 per cent over the non-participating farmers.

#### ***5.4. Approach-IV: Gender sensitive extension approach in rice farming***

The gender sensitive extension approach in rice farming was designed and tested in Sankilo village of Cuttack district with the involvement of over fifty participating



farm women during 2012-17 and is being carried forward in an entrepreneurial mode since then. The village was selected after making due consultations with the households and finding the social climate relatively better in gender sensitiveness. Preliminary meetings, gender sensitization programmes, gender gap analysis and PRA studies were undertaken by involving both male and female key informants separately to identify major gender issues in rice farming.

The major gender issues in rice farming identified included women-friendly technologies, access to resources & information, labour sharing, benefit sharing, capacity building, group mobilization, decision-making pattern, societal gender mindset, constraints in farming, linkage with financial & marketing institutions etc. Accordingly, suitable technological and institutional interventions were provided and evaluated. The male heads of the families/ the legal owners of lands were sensitized and motivated through personal contacts and close interactions to allocate about half an acre rice growing land to all the participating family farm women to take up crop demonstrations as per the advice of NRRI scientists and take independent decisions on crop management. A women development group in the name of 'Ánanya Mahila Bikash Samiti' was formed and registered after mobilizing all fifty farm women for deriving maximum institutional benefits and for group sustainability. Intensive awareness camps were organized and trainings imparted for desirable changes in their skill, knowledge and behaviour with regard to the objective of the programme, rice production technologies, market support and possible outcome of the project.

Demonstrations on rice production and crop management practices on popular and suitable rice varieties based on women's preference and market demand were conducted in the allotted half acre land by each farmwoman during kharif seasons. Apart from rice, during rabi seasons, technological interventions on cultivation of high value vegetable crops, pulse crops and preparation of value added food products were also given. Seeds and planting materials were provided free of cost as critical inputs during initial years only. Improved rice production technologies like growing of mat type nursery, seed treatment, line transplanting, use of rice transplanters, balanced dose of fertilizer application and need based pesticides application were provided along with technical backstopping in women's perspectives. Similarly, for harvesting and post-harvesting management, training-cum-demonstrations on drudgery-reducing and women-friendly machines and technologies like NRRI rice-parboiling unit and NRRI rice-husk combuster; and demonstration on paddy-straw mushroom cultivation was also conducted for additional revenue generation and family nutrition from rice by-products.

Looking at their acquisition of enough technical competencies and managerial abilities, the group was made as a signatory to the NRRI developed rice value chain for ensuring greater economic benefits of the participating women members. Reactions of the farm women were recorded at regular intervals to assess the effects of interventions and modify accordingly, if called for. The major impacts of the project in terms of outputs and outcomes as found out through concurrent and end-term evaluations are briefly outlined below.



- a) Change in attitude towards gender mainstreaming: Significant change in attitude towards gender mainstreaming was established. The male members of the family as well as in the village are now giving more importance and recognition to the farm women in farm, family and community matters. More so, they were happy and motivated to see and watch the success stories of their village in print and electronic media. They are now allowing female members to attend agricultural meetings and programmes outside.
- b) Mindset of male members of family/society: Findings indicate that there was major change in the mindset of male members of family/society towards women-managed rice farming (90%). All the farm women were feeling recognized by other members of the family as well as village due to their increased capacity in farm and home management activities and leadership in organizing group and social activities.
- c) Competency of farm women: As opined by the farm women, remarkable changes in behavior of women rice growers were found with regard to agricultural knowledge (100%), technical skill (93.33%), decision-making capacity (86.67%) and undertaking group activities (76.67%). Improvement in skills in nursery raising, handling farm implements, and disease and pest management were also observed.
- d) Women friendly production technologies: Technologies with regards to raising of mat-type seedlings for mechanical transplanting, seed treatment, mechanical line transplanting and use of small farm equipments were found drudgery reducing. Among the women-friendly farm machineries demonstrated, rice husk combuster, finger weeder and 4-row manual drum seeder were perceived as more appropriate by 85.71%, 70.37% and 57.14% farm women respectively. Paddy straw mushroom cultivation as an income generating activity by converting rice byproduct (straw) was also rated as more appropriate by 88.46 per cent farmwomen.
- e) Perception about of demonstrated technologies: All the participating farmwomen adopted scientific production practices based on their socio-economic feasibilities. The analysis of the data shows that majority of the respondents had positive perceptions with regards to comparative advantage of recommended/demonstrated rice varieties over earlier grown varieties in terms of yield, resistance to pest/diseases, tolerance to weeds/drought, labour saving, profitability and marketability.
- f) Access to productive resources: Significantly increased access of women to farm inputs was observed through the approach, as evident from the expansion of allotted half an acre land to over one acre in many families by end of 2-3 years. This expansion of area under the control of farmwomen signifies more trust and confidence on women farmers by their male counterparts and a positive impact of the project. Similarly, accessibility to family land (100.0%), seeds (100.0%), fertilizers (100.0%), and money (45.45%) were found.
- g) Entrepreneurial opportunities: Since, the farm women had their expertise in preparing traditional value added food products (VAPs), they were encouraged and supported to convert the traditional value added rice products into demand driven marketable products through improved food technology process. A book

on ‘Traditional Rice Foods - The Rich Heritage of India’ was also brought out containing the processes of making over hundred traditional rice-based value added products, primarily collected from the women group members.

- h) Partnering in RVC: By working in groups, the women realized their inherent capacity, developed friendly atmosphere and learnt the importance of working in groups in the society. Accordingly the registered group also took up entrepreneurial activities as a signatory to the NRRI rice value chain and in turn potential women entrepreneurs were recognized.
- i) Outstanding public recognition: Among others, one of the successful farm women Smt. Rukmini Nayak of the group was conferred with ‘Best Innovative Farmer Award’ during ‘Krishi Unnati Mela-2017’ at IARI, New Delhi and with ‘Best Farmer Award’ during ‘Akshay Tritoaya & Farmers Fair-2016’ at NRRI, Cuttack apart from several other awards and recognitions, and received these awards from Hon’ble Union Minister of Agriculture & Farmers Welfare, Govt. of India.

### ***5.5. Approach-V: Developing a rice-based climate smart model village through convergence***

The National Rice Research Institute took up an initiative to demonstrate and develop an extension approach for ‘development of a rice-based climate smart model village’ with a broad objective of achieving all round development of Indian villages in convergence mode with emphasis on sustainability and equity during 2012-17. It was conceptualized as a holistic developmental model in a convergence mode involving various stakeholders like NRRI scientists, line departments, development departments, farmers associations, farmers, farmwomen, rural youths etc for achieving capacity building and overall development of farming communities through agriculture and allied activities.

The development of rice-based climate smart model village, evaluation of interventions and recommendations were taken up in a rainfed cluster, namely Gurujang-Guali of Tangi-Choudwar block of Cuttack district in Odisha. The cluster was selected because most of the people were socio-economically disadvantaged, the population comprised of mixed castes and livelihood, mainly dependent on rainfed rice-based farming options and facing many adversaries of climate change. There were about 100 farm families in the cluster with a total population of about 800. Based on bench mark survey and PRA studies, suitable technological and institutional interventions were provided and evaluated. Participatory technology demonstrations on rice, vegetables, animal husbandry, fisheries, group vegetable farming by women and allied activities were conducted. Capacity building of beneficiary farmers, farmwomen and youth was done through training, farmers-resource persons interactions, exposure visits and continuous technical backstopping. Village level stakeholders’ meetings and workshops were organized by involving officers of the stakeholders departments (agriculture, horticulture, animal husbandry, fisheries, soil conservation, irrigation, panchayatiraj, cooperative etc), farmers and farm women of the cluster and scientists of the institute for developing a holistic approach and



mechanism of convergence among the departments. The priority needs of the cluster were identified as rain water harvesting under watershed and minor irrigation programme, control of wild buffaloes and stray cattle during rabi season and management of weeds in rice and vegetable crops.

Seasonal and annual action plans developed for the purpose were monitored from time to time for their effective implementation in a participatory and convergence mode. The high yielding rice varieties namely Sahabhabgadhan, Swarna Sub-1, Pooja, Ketekijoha, Varshadhan, CR Dhan 304, CR Dhan 202 and Naveen were most liked due to their various motivational traits. Climate resilient varieties namely, Sahabhabgadhan (drought), Swarna Sub-1 (submergence), Varshadhan (deepwater & waterlogged), CR Dhan 202 (aerobic) etc. were introduced in the cluster and proved high adaptability and acceptance by the farmers. Prior to project interventions, they were cultivating HYVs of rice in about only fifteen per cent of rice growing area, which increased to about ninety percent at the end of five years. Farmers were still growing some local varieties due to their special grain and cooking quality.

The influence and benefits of group vegetable farming by women were very well noticeable and might help formation of more women groups for vegetable farming. The performance and impact were assessed which revealed that a very high percentage (94%) of farmers of model village had well derived various socio-economic benefits from the rice-pulse-horticulture-poultry-pond based production technologies propagated by the institute. The farming habit has changed. The fallow back yard lands of households have been covered under kitchen gardening or mushroom units or poultry units and the drought prone lands have been covered with drought resistant rice varieties or pulses. Apart from improvement in farming and socio-economic conditions of the villagers, village sanitation has also improved with the support from the block development department through construction of village pucca roads and individual household safety toilets. A study conducted in the cluster to assess the direction of changes revealed that significant positive changes had taken place with respect to attitude towards hybrid rice, knowledge on high yielding varieties, knowledge on rice cultivation, soil nutrient management, pest control and farm mechanization. Youths have been motivated to assist parents in farming activities or have taken up some kind of independent income-generating activities.

## 6. WAY FORWARD

As part of the institutional effort, cluster demonstrations were conducted during kharif 2017 involving 60 farmers in Jharkhand (with CR Dhan 202 and CR Dhan 305); 24 farmers in West Bengal (with CR Dhan 201, CR Dhan 203 and CR Dhan 304) and about 200 farmers in Odisha with 20 new rice varieties released for the state. The crop cutting results of almost all the demonstrated varieties showed a grain yield advantages of about 10-20% over all the existing popular varieties. A demand for seeds of these varieties has been created among the farmers. There is need to upscale these activities in convergence with other stakeholders in years to come.



Information technology and FPO are effectively integrated in 4S4R model which makes seed available at local level to ALL farmers according to their NEED, in right QUANTITY, of right QUALITY, at lower COST and TIMELY delivery, which the present formal seed system has FAILED to deliver. This project activity enriched the subject on IT/ICT application in agriculture in general and dissemination of technology in particular. This has involved expert systems, GIS, MIS, web-based applications and mobile based methods for information dissemination. Another aspect that activity this project contributed, is development of approach to form FPO as an extension method for planned and organized transfer of technology and marketing.

The rice value chain approach has to be validated by widening the stakeholders' base, involving more number of rice millers, processors, traders and farmers organizations to generate competitiveness. Apart from long grain aromatic varieties, high value non-aromatic and nutritionally enriched high protein, high zinc rice varieties can be put into the chain. Nutritional rice varieties enriched with protein, iron and zinc can be promoted through government welfare schemes like mid-day meal for school children and Antyodaya Anna Yojana. Studies on marketing through e-national agricultural marketing (e-NAM) portal could be explored.

Access to productive resources is critical for enhancing women's economic choices. Since, formal credit institutions rarely lend to this weaker sex, special institutional arrangements has become necessary to extend credit to those who have no collateral to finance their enterprise. In order to have access to credit, social, institutional and government support is required. More than half of the farm labour is contributed by farm women. Moreover, as evident from several literatures, they have also proven their competencies over time and again to manage farm and home efficiently and effectively at par with the male members of the society, provided they were supported socially, economically, morally, technologically and institutionally. There is a need to identify their hidden capacities and entrepreneurial abilities and link them to the market. If they can be made technologically competent and socio-economically empowered, they could be the efficient drivers in achieving accelerated agricultural growth and development of the country in general and in boosting family income in particular. Organizing women into groups has been proved to be a good intervention. It can transform women from the status of 'beneficiaries' into 'clients', who are in a long-term can have a reciprocal relationship with the institutions meant to serve them.

The model village approach has successfully integrated all stakeholders in the development of rural India in a participatory and convergence mode. In addition to addressing the issue of socio-economic and agricultural development, climate issues have been suitably addressed. The model needs to be validated and refined in other parts of the country and should be replicated in bringing prosperity to the society.



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