Globelics 2010
8th International Conference

Making Innovation Work for Society: Linking, Leveraging and Learning

1 - 3 November 2010
University of Malaya, Kuala Lumpur, Malaysia

Exploring Mechanisms for Putting Agriculture Value Chain Oriented Research into Use: Empirical Cases from the Research Into Use (RIU) Program

Name of Corresponding Author	T.S.Vamsidhar Reddy
Title & Position	Research Fellow, Central Research Team, Research Into Use Program.
Institution & Full Postal Address	Centre for Research on Innovation and Science Policy (CRISP), Karma Enclave, Road no. 10, Banjara Hills, Hyderabad – 500034 India
E-mail Address	tsvreddy@hotmail.com

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Vamsidhar Reddy TS[1], Rasheed Sulaiman[2] and Andy Hall[3]

Abstract

This paper presents three projects of the Research Into Use Program, located in South Asia, which are applying three agriculture value chain development oriented knowledge for wider use. Practical aspects of the process and roles played by different types of agencies in the innovation are discussed. Evidence is provided from the cases that the initial stages of innovation trajectory comprise of social engineering and creation of appropriate architecture of actors, after which need for new knowledge arises and favourable conditions develop for putting such knowledge into use. The cases also present how different types of agencies assume lead roles during different stages of innovation trajectory.

Key words: Agricultural innovation; value chain innovation; Research Into Use.

1. Introduction

Agriculture research and development paradigms have been undergoing continuous transformation over the last few decades to be relevant and effective. The linear model of agriculture development with public research agencies as the sole source of knowledge and the extension functionaries transferring those messages to farmers has been found irrelevant in most contexts of agriculture development. This is because of a general appreciation that agriculture development is a context specific embedded process involving diverse agencies operating based on their respective mandates and interests.

[1] Research Fellow, Central Research Team, RIUP
[2] Coordinator, Central Research Team – Asia, RIUP
[3] Leader, Central Research Team, RIUP

Due to this, there has been increasing appreciation for innovation system perspectives for agriculture research and development. There are increasing numbers of programmes and initiatives supported by both international donors and national governments to showcase and popularise this conceptualization. The Research into Use Programme (RIUP) is one such initiative supported by the Department for International Development (DFID). This programme is supporting different initiatives on putting knowledge generated by many years of agriculture research into use in different parts of Asia and Africa,

Generally, there has been concurrence among different theorists on the key underpinnings of agriculture innovation process. However, they have been promoting different narratives for the innovation process, ranging from poor/user-led innovation to researcher-led innovation. These narratives endorse different configurations of stakeholders and assign different roles for them in the innovation process. The Research Into Use (RIU) programme's Central Research Team (CRT) conceptualized that the best way to approach it is by having a diversity of these Innovation Narratives, which probably suit different agriculture development contexts. They are trying to substantiate this thinking by investigating empirical cases in different locations of the Programme. Opportunity led Innovation is one such narratives under investigation, under which, value chain innovations is categorized. The current paper discusses three cases of RIUP from Asia which are putting value chain oriented knowledge generated by previous projects into use. It explores the clusters of actors that are involved in these efforts and how they are configured, and what mechanisms and processes have contributed for innovation. The paper starts by presenting the theoretical framework, followed by the three cases, key lessons from them and then concludes with implications for policy and practice.

2. Theoretical framework

Changing paradigms of agriculture research and development in Asia: coming-up of agriculture innovation conceptualization

Asia has witnessed exploration of different conceptualizations for agriculture research and development during different periods in the past few decades. The model of agriculture development promoted during 1960's with research agencies as knowledge

providers and extension agents as transmitters of that knowledge to farmers has been found irrelevant for the dynamic context of agriculture (Chambers and Ghildyal, 1985). However this is probably the only model that was so widely promoted in developing countries for more than twenty years. To cover these short-comings few agencies promoted the Farming Systems Research (FSR) approach during 1970's and 1980's, which expected researchers to be aware of farmers' situations and provide technological options that are suitable for diverse farming contexts. Though it was more appropriate to its predecessor, it also considered researchers as the sole providers of solutions to farmers' problems, while farmers are the objects of study and providers of information. During this period, strong evidences were provided for multiple sources for knowledge, including farmers (Biggs, 1990). Taking such evidences into consideration the Agriculture Knowledge Information Systems (AKIS) framework was promoted, which recognized multiple sources of knowledge and the need for collaborative working by different agencies connected to the agriculture system to promote sustainable agriculture (Roling and Wagemakers, 1998).

The more recent, innovation systems conceptualization for agriculture development furthers the thinking on multi-actor role; and the institutional context of knowledge generation, dissemination and use (Hall et. al., 2004). It highlights that technological, institutional and policy innovations are interlinked and building capacity of different actors in the system to collaborate is the most appropriate way of promoting innovations (World Bank, 2006). To support this conceptualization there is growing evidence to suggest that embedding research in the system of technology users and intermediaries would aid in better use of the research products (Hall and Sulaiman, 2008). Barnett (2006) provided evidence that organizing research as part of a coalition of development, entrepreneurial and policy actors can improve impacts. Experience has also shown that when organizations with varied expertise network and start engaging in joint activities, it leads to organizational and institutional changes and enhance application of new knowledge. Moreover, the process also leads to raising new relevant research questions and also triggers new demands for technical support (Hall et al, 2009; Sulaiman R, 2010).

Agriculture innovation process and the role of intermediary agencies in agriculture innovation

Innovation can be understood in simple terms as the dynamic process of interaction in specific institutional and policy contexts (Mytelka and Bortagaray, 2005) This interaction enhances the capacity of the system to identify, adapt and exploit new or old knowledge from its wider environment. This can be considered as the innovation capacity of the system and catalysts or boundary organizations play a very important role for developing this (Farrington and Biggs, 1990; Horne, 2008; Klerkx *et al.*, 2009; Kristjanson, 2009). Innovation capacity determines how organizations respond to innovation triggers like changing policies, markets, environments and technology (Hall *et al* 2004; World Bank, 2006).

Sumberg (2005) proposed that innovation brokers are very important for spurring the interaction of different system actors, which leads to the development, and sharing of knowledge and ultimately building of innovation capacity. Cases show that when there are knowledge seekers and knowledge providers in the system, but they are unable to interact, the brokerage function emerges (Röling and Wagemakers, 1998; Klerkx and Leeuwis, 2008). Rivera and Sulaiman (2009) suggest that intermediary agencies/ brokers increase interaction among different components of a network or system, which is important for promoting innovation.

Biggs (1990) and Eicher (2007) presented cases on how innovation brokerage is increasingly becoming important in agriculture systems. Contrary to the popular opinion, Rajalahti *et al.* (2008) argued that market opportunity alone is not sufficient to encourage collaboration and partnerships, which are key for innovation. Similar opinions were expressed by a study by the World Bank (2006) which found that even when there were strong market incentives for players to collaborate for innovation, linkage formation was still extremely limited. It was strongly proposed by Hall *et al* (2004) and Klerkx and Hall (2009) that organizations which perform brokering roles are essential for establishing or strengthening connectivity in networks that can result in innovation. Klerkx *et al.* (2009) proposed that innovation by its very nature involves several players with similar or

competing interests and innovation brokers may address these concerns simultaneously or sequentially.

In spite of such elaborate theories about innovation process, there is less number of empirical cases from Asia that present the actual agriculture innovation process. The RIUP provides that opportunity. The following section presents in brief about the RIUP and then presents the value chain oriented cases of it.

3. Value chain oriented projects of RIUP in Asia

Ten years (1995-2006) of research, funded by DFID's Renewable Natural Resources Research Strategy (RNRRS) has generated new knowledge that is expected to address the needs of poor communities living in Asia and Sub-Saharan Africa (SSA). The final evaluation of this program suggested that though it has generated good scientific research, its developmental impacts have been modest (Hall A., 2010a). Subsequent to this, the Research into Use Programme (RIUP) was undertaken with an aim to maximise the poverty-reducing impacts with the newly generated knowledge. In practice it is about putting into use the knowledge generated by RNRRS in wider areas to reach larger sections of the communities and have positive impacts on their livelihoods. To be effective, it could only be done through a context-embedded process involving relevant stakeholders. In line with this thinking, different agencies implementing RIUP components are trying different approaches in Asia and SSA. All these approaches have potential to generate lessons, which could be used for planning future research for development interventions. The Central Research Team (CRT), commissioned by RIUP, is trying to synthesize these lessons, with focus on the processes involved in putting into use of the knowledge.

Among these diverse initiatives, a group of RIUP projects in Asia are putting into use value-chain oriented knowledge generated from RNRRS initiatives. For the convenience of synthesizing lessons, the CRT has classified them under the opportunity-led innovations category. For this category, it is hypothesized that – "opportunities presented by large markets of poor people are leading the emergence of new types of innovation processes and products. Also emerging are innovation process that are invisible to

research and corporate communities due to alternative professional views of excellence and success. These are described in various forms such as 'bottom of the pyramid' innovation and 'below the radar' innovation. Innovation along value chains is a key feature of these developments." (Hall A., 2010)

The Cases

Three groups of agencies are involved in facilitating three cases of value chain innovation. They are adopting different approaches to put into use three different value chain oriented knowledge. One group led by the International Development Enterprises (IDE) in Nepal is putting into use the Participatory Market Chain Approach (PMCA), to work with existing components of the value chain in that country and connecting them to small-holder farmers to help access larger markets. The other group led by the Coalition to Diversity Income from underused crops (CoDI), promoted by the International Centre for Underutilized Crops (ICUC) and BAIF in India, is building a value chain through putting into use a multi-pronged approach to connect small-holder producers of underused crops to markets. In the third case, a consortium led by Rangpur-Dinazpur Rural Services (RDRS) in Bangladesh is developing a fish seed value chain by creating new role for small-holder farmers in the value chain while putting into use the Decentralized (fish) Seed Production (DSP) approach.

The following table 1 presents some of the key features of these three cases.

Table 1. Key features of three value chain oriented projects of RIUP in Asia

Feature	CoDI case	IDE case	RDRS case
Assembly of the cluster of actors	At program level - Key stakeholder representatives are organized in a coalition and involved in program implementation At field level – Value chain is developed	At program level – Key stakeholder representatives are in the advisory committee and play supervisory role in program implementation At field level - Key	At program level - Key stakeholder representatives are working as part of a loose network and are supporting program implementation At field level – Value chain is developed by

	through a multi-pronged approach. Existing components of value chain are joining voluntarily.	components of the existing value chain are brought together through PMC approach.	creating new roles and strengthening linkages among existing agencies.
Approaches/ strategies for putting existing knowledge from RNRRS into use	Different streams of existing knowledge is appropriately mixed to continuously develop an approach for value chain innovations	Proven knowledge is being adapted and adopted in a different context for innovations around value chains	Proven knowledge is being scaled-up/out in a larger area through innovations around value chains
Mechanisms/ strategies for integration of research in the innovation process	Research organizations are part of the coalition and there is a two-way feedback and information sharing.	Small holders' organizations are capacitated to articulate need for research outputs to research agencies.	Research organizations are part of the network and there is two-way feedback and information sharing.
Features and ways of making the effort pro-poor	Focus on vegetables and fruits that are mostly cultivated by small holder farmers on degraded lands	Focus on building capacities of small holders' organizations	Focus on developing small-holder rice field farmers and seasonal pond owners as producers of fish seed.
Produce in consideration	Under used/ traditional crops (cereals, fruits and vegetables)	Main-stream fruits and vegetables	Fresh water fish species that are self-recruiting
Status of the existing value chain	Mostly absent	Mostly present but with inefficiencies and missing links	Mostly present but with inefficiencies

Intervention in the value chain	Simultaneously building different components of the value chain. Allowing existing components of the value chain to join in their own business interests.	Building capacity of small holders' organizations to identify and respond to market opportunities. Building linkages among different components of the existing value chain	Creating role for small-holder farmers in the fish seed value chain and strengthening linkages among existing components of fish-seed value chain

The following section presents key early stage lessons by citing examples from the three cases.

4. Early stage lessons

The following section present some early stage lessons of exploring these three cases.

4.1 Initial stages of innovation trajectory consists of developing appropriate configuration of agencies and social engineering, while the need for new knowledge arises at later stages

Experiences from all the three cases seem to indicate that a foundation needs to be established, in the form of appropriate organization of primary stakeholders and creating/ strengthening linkages among relevant agencies, before application of any new knowledge. After such social engineering demand for new knowledge arises and favourable conditions develop for putting new knowledge into use. As shown in the cases below, this is probably because, putting new knowledge into use is a social process in which different types of agencies play their part during different stages of this process and interactions among them holds the key.

The following case histories present how a gradual process of stakeholder interactions and linkage creation results in demand for newer knowledge and innovation.

IDE Nepal's activities leading to application of the PMCA

Since early 1990's IDE Nepal's key activities have been about participatory research to develop and provide appropriate micro irrigation technologies such as drip systems, micro sprinklers, treadle pumps (manual foot pumps), and water storage / distribution technologies. Through these activities they developed trusting relationships with farmers and rural communities. As time went by, based on demand and realizing the opportunity, they also developed and provided appropriate agricultural equipment for coffee processing, essential oil distillation, and for a variety of high value sub-sectors such as spices/herbs, non-timber forest products (NTFPs), livestock, and fisheries. While engaged in these activities, they realized that there are tremendous opportunities for poor farmers in Nepal to rapidly increase their incomes by supplying some of these high-value agriculture produce, especially vegetables, for the national and international markets. However there were some constrains for that, such as – unorganized nature of small-holder farmers producing small quantities of vegetables and inefficiency in the existing value chain for vegetables characterized by missing actors and insufficient connections between actors. (See figure 1)

In order to address these constrains and support these small-holder farmers to access larger markets, they promoted community managed collection centres (CC) for vegetables, which serve as a point of aggregation of vegetables to attract local traders. Farmers were organized into farmers groups (FG) and these were federated at block level under respective CC. A Marketing and Planning Committee (MPC) was promoted for each of the CC as the executive body to run these centres. Their capacities were systematically built to represent interests of their member farmers and negotiate for benefits with different stakeholders. Due to such social organization, farmers received better prices through product aggregation at CC and better bargaining by MPCs. Input dealers in these areas were provided with crop production resource books and were encouraged to photocopy relevant pages of that book and share them with farmers for a nominal cost, when they visit them for buying inputs. By this way, farmers' interactions with input dealers were enhanced. These input dealers were encouraged to attend meetings organized by MPC at CC and thus created a two-way feedback mechanism. MPCs were capacitated to contact department of agriculture (DoA) and Village

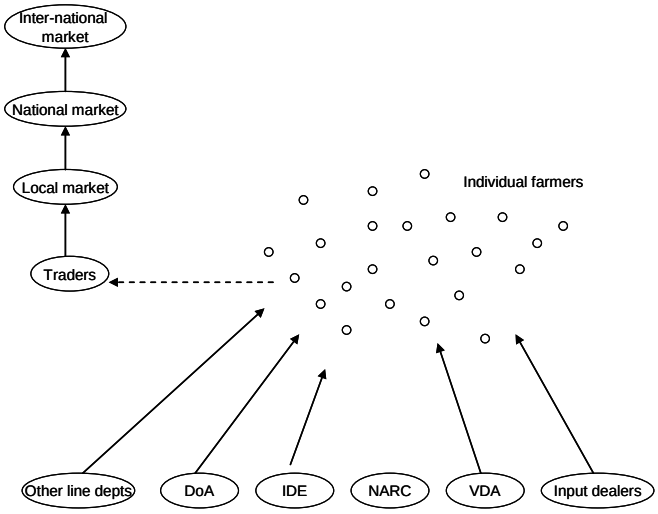
Development Committees (VDC) to access their programmes and funds. The FGs were registered with the DoA and MPCs were registered under the Co-operatives act, to formalize and institutionalize these organizational structures for their sustainability. All these interventions were undertaken as part of their Rural Prosperity Initiative (RPI) and Smallholder Irrigation Market Initiative (SIMI) projects. However there existed mistrust between farmers and traders. Price was never shared openly by traders, farmers complained about exploitation by traders while traders complained about lack of regular supplies from farmers. The linkages established among different agencies through CC remained just mechanical with lack of whole-hearted collaboration. Due to this situation, the impacts expected from these interventions were not up to the expected level.

To address these issues and to enlarge benefits by accessing larger national and international markets, MPCs lacked necessary capacities and skills. While exploring opportunities to deal with these situations, IDE came across PMCA as a useful methodology to move to the next level of market operations. Through this methodology, management capacities of MPCs were built to respond to different types of market opportunities. The Thematic Groups (TG) that were promoted through PMCA – consisting of representatives of farmers, traders, input dealers, consumers (such as restaurant owners, etc.) and MPC members – became a mechanism for building trust among these diverse stakeholders. The interactions and joint activities taken up during different stages of PMCA helped clarity misunderstandings among different stakeholders and paved way for collaborative working.

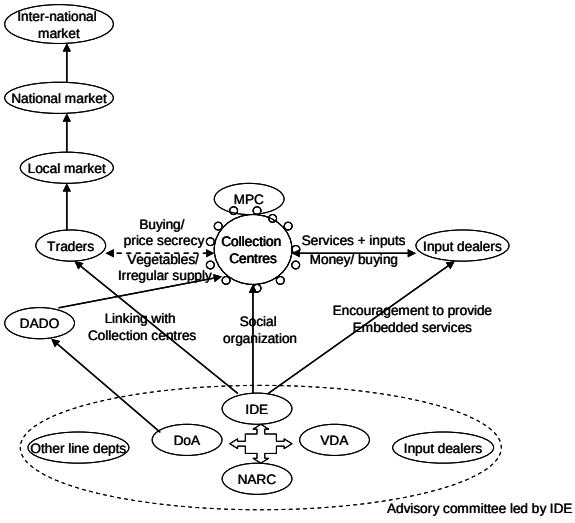
Discussions with different agencies that are associated with this initiative at programme level and the field level clearly showed that the foundation laid in terms of organizing farmers and linkages established among different agencies, helped adopt the PMCA effectively and benefit from it. After witnessing these interventions and direction of impacts, the Advisory Committee of IDE, with Director General of DoA as its Chairman, in its recent meeting on 21 May 2010 appointed a task force to study how PMCA could be adopted by DoA in other parts of the country.

The following figure 1 presents different stages of the intervention.

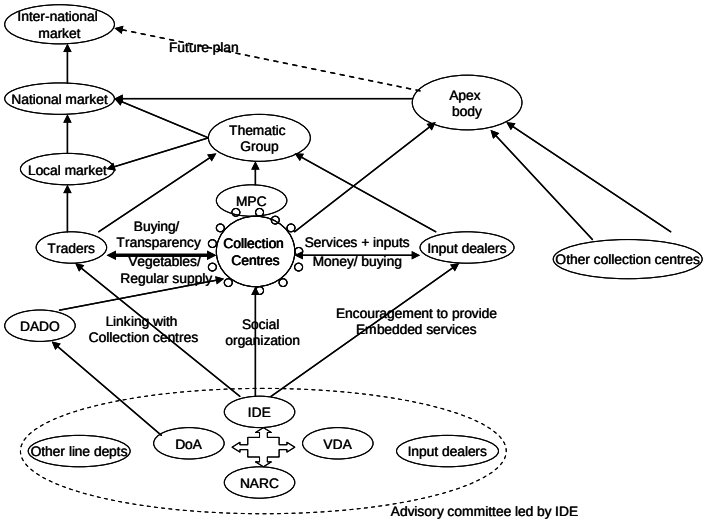
Figure 1. Different stages of stakeholder architecture in promotion of PMCA



Situation 1: Relevant actors and their relationships – Starting conditions in the innovation trajectory



Situation 2: Relevant actors and their relationships – Institutional architecture created through other initiatives before introducing PMCA



Situation 3: Relevant actors and their relationships – PMCA introduced and relationships promoted to the next level

Development of CoDI for promoting UC:

The BAIF Development Research Foundation, with more than four decades of implementing diverse rural development initiatives in India, has been working on promoting UC since late 1980s'. In the initial stages they collaborated with the Oxford Forestry Institute in their research activities on identifying suitable hardwood species for fodder and fuel-wood needs of rural communities. During the same period, they also initiated their *Wadi* programme in Valsad district in South Gujarath, which is in essence about promoting agri-horti-forestry plots on degraded lands belonging to resource-poor villagers as a sustainable option. Its success in that area encouraged them to promote it in six states covering about 0.1 million families and 40,000 hectares. All these farmers were organized into groups and federated at higher levels. As part of this initiative they promoted cultivation of mango (*Mangifera indica*), cashew (*Anacardium occidentale*), guava (*Psidium guajava*), custard apple (*Annona squamosa*), amla (*Emblica officinalis*), lemon (*Citrus spp.*), sapota (*Manikara zapota*), drumstick (*Moringa oleifera*), tamarind (*Tamarindus indica*) and bael (*Aegle marmelos*). Of these, tamarind, bael, fruit part of cashew, etc. are widely considered as underused crops.

Recognizing BAIF's expertise, the International Centre for Underused Crops (ICUC) collaborated with them for research activities on UC, since its inception in 1992. Focus of this collaboration was on farmers' participatory surveys, agronomic trials on production and post-harvest technologies, and publishing extension literature in local languages. They also partnered in regional networks such as Underutilized Tropical Fruits in Asia Network (UTFANET), represented by diverse agencies from research and development sectors, which were promoted for wider dissemination of knowledge and information about underused crops. Through programmes such as the Fruits for the Future Programme (1998-2001), they worked with local research and development organizations for conducting training programmes for selected farmers and NGO staff on production and post-harvest aspects of few UC in local languages. Extension literature was also developed and distributed widely. At this stage the general assumption seems to be that of collating and disseminating knowledge about production and processing of UC, would ensure putting that knowledge into use.

In the subsequent stages, they implemented a survey titled - Processing and Marketing of Underutilized Crops In India and projects such as – "Improved livelihoods through the development of small-scale fruit processing enterprises in Asia" and "Community Participatory Processing of Underutilized Fruits". While implementing these initiatives, they enhanced their relationships with different agencies from research and development sectors that are connected with UC. During this period, the BAIF's *Wadi* programme developed further. They established processing and marketing facilities for the produce from individual farmers' plots through farmers' federations and cooperatives.

More importantly while implementing these initiatives, they realized that making knowledge available addressed only one aspect of the problem and there were other constrains for promoting UC, such as – lack of free access to plant propagation material of required species; unavailability of post-harvest and processing technologies; and lack of linkages to markets and other service providers. There were supporting evidences from the research efforts of ICUC and its partners (Anthony & Haq 1997, Haq, 2000, ICUC 2000) and discussions at a Regional Consultation meeting (Haq & Hughes, 2002).

To address these issues a multi-stakeholder initiative called Coalition to Diversify Income through Underused Crops (CODI) was promoted and a multi-pronged approach was developed (See figure 2), by putting together knowledge generated during different RNRRS initiatives. Different types of agencies which worked together during earlier initiatives were members in CODI.

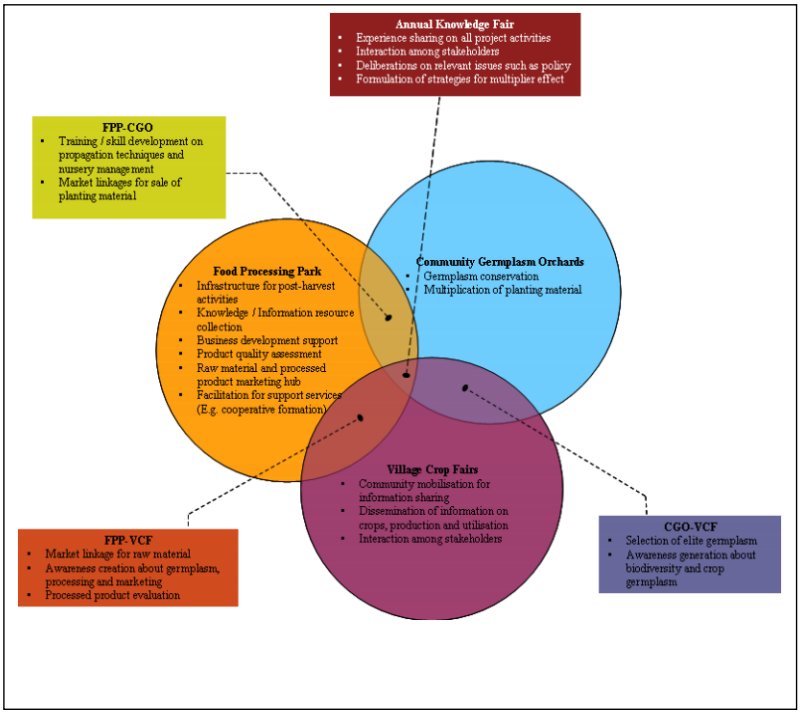


Figure 2. The Multi-pronged approach promoted by CoDI
Source: Project documents of CoDI

The Community Germplam Orchards (CGO) were promoted as mechanisms for individuals and farmers' groups to multiply plant material to be supplied to interested growers. The Village Crop Fairs (VCF) were promoted as mechanisms where different agencies come together to share their learnings and interests about UC, and also convey their requirement for plant material to be produced in CGO. The Food Processing Parks (FPP) were promoted as places where all the facilities required by local communities for post-harvest and marketing of UC are available. This approach was tried in areas where the *Wadi* program has been successfully implemented. The social architecture and linkages among relevant agencies created in that program helped in application of this approach in those areas. These two initiatives mutually complimented. UC were added in the existing *Wadi's* agri-horti-foresty plots and the CGO and FPP facilities helped both the initiatives to benefit. Linkages established with Universities and research stations helped extend technical support to UC while the market channels established helped promotion of UC.

Discussions with different agencies connected with the initiative, clearly indicated that the social infrastructure created during the *Wadi* program and other previous initiatives helped in promotion of the UC through the multi-pronged approach. During the recent (March 2010) visit to project locations, it was evident that the initiative is growing with new crops and new products getting added continuously by the interests of the associated agencies.

<u>Promoting Decentralized fish Seed Production (DSP) in Bangladesh:</u>

Rangpur-Dinajpur Rural Services (RDRS) is an NGO that is leading a consortium of organizations including NGOs such as PROVA, SACHETAN, ACD and Practical Action; and strategic partners such as IDE-Bangladesh for their market development expertise, World Fish Centre for their technical expertise and Department of Fisheries for their technical mandate. The NGOs of the consortium have been working with villagers in their respective areas since many years. They promoted different organizations of these villagers such as farmers' groups, Self Help Groups and federated them at higher levels. The importance of freshwater aquaculture for supporting livelihoods of small-holder farmers in Bangladesh has been well appreciated during their interactions with villagers.

It is also a well known fact that availability of good quality fish seed is very important to support successful small-holder freshwater aquaculture. Realizing this opportunity in the past few decades, many public and private sector hatcheries have sprung-up in the country, increasing the availability of fish seed. However, domination by some large hatcheries managed by powerful people and less effective public sector hatcheries resulted in higher cost of fish seed. Clustered-nature and distant location of these hatcheries required longer distance transportation by seedling traders (*patheelwalas*) and caused higher mortality and added the transportation cost. Monsoon-dependant farming in these areas (*Barind* tract) resulted in higher demand and higher costs of fish-seed during peak seasons. These formed serious constraints for accessing good quality fish seed in correct time and at appropriate prices. Due to these, the need for decentralization of fish-seed production was clearly felt by all the concerned parties.

Decentralized Seed Production (DSP) approach has been developing in Bangladesh over a long period through different project initiatives. The first attempt seems to be by a project called Northwest Fisheries Extension Project (NFEP)[4], during 1991 in NW Bangladesh. They attempted decentralized common carp seed production, by collection and translocation of spawn deposited on aquatic plants from household ponds and ditches to rice fields. There were encouraging results from that. This approach was further popularised by the Cooperative American Relief for Everywhere (CARE) through their Integrated Rice Fish (Interfish) Project, supported by DFID during 1992. At this stage this approach was promoted mostly for Integrated Pest Management (IPM) in rice cultivation. In the later stages its potential for fish seed production was realized and promoted for that purpose. During this period, the seed production in rice-fields was limited to common carp, which changed with the introduction of GIFT (Genetically Improved Farmed Tilapia). The Asian Development Bank (ADB) supported Bangladesh Fisheries Research Institute (BFRI) to introduce GIFT in 1994, as part of a project on

[4] The Northwest Fishers Extension Project (NFEP) was supported by DFID in two phases during 1988-2000. The regional focus was the impoverished Northwest region of Bangladesh, characterized by infertile soils and unfavourable climate for agriculture resulting in lowest agricultural and pond fish productivity. Sandy soils and a 6-month dry season do not allow application of pond polyculture of carp that is prevalent in other parts of Bangladesh. The NFEP trained and used more than 1,000 fish seed traders and more than 250 secondary school teachers as extension agents. They established more than 200 model villages in which more than 9,000 farmers received training in aquaculture.

"Dissemination and evaluation of genetically improved tilapia in Asia". This strain has distinct advantages for farmers' situations. In 1999, this improved strain of tilapia was introduced as part of a research trial with farmers in the NFEP. The Go-Interfish project, implemented by CARE during 2000-2005, further expanded production of common carp and tilapia (GIFT) in rice-field plots. Subsequent projects such as the project on "Improving fresh water seed supply and performance in smallholder aquatic systems in Asia" clarified many perceptions and further advanced the knowledge about freshwater fish seed production in Asia.

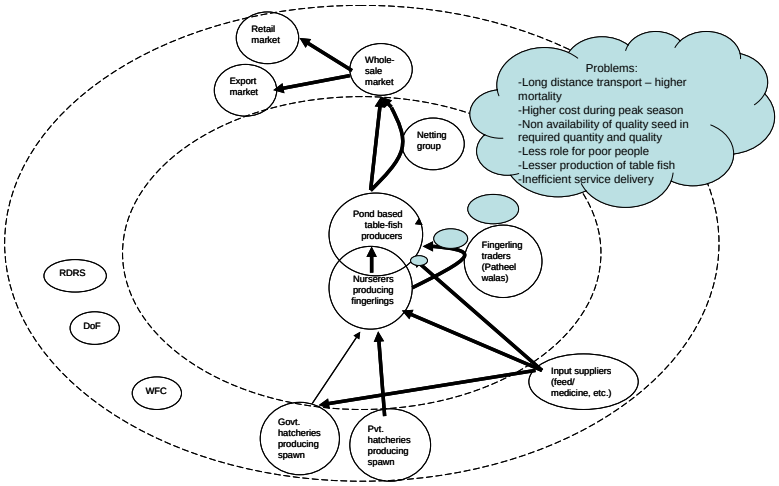
All these efforts contributed for development of knowledge on DSP, however to put this knowledge into use an architecture of agencies was required. Prior to the RIUP initiative, RDRS was supporting the research efforts of the World Fish Centre to promote DSP. As part of those efforts they introduced DSP in selected individual farmers' fields. They supplied GIFT seedlings to farmers and helped them to cultivate those in their rice fields by making necessary modifications to their rice plots. Farmers successfully cultivated them, benefited through additional income from GIFT fingerling sales and enhanced availability of fish for home consumption. These individual farmers continued to practice DSP. But the technology did not spread widely. The main reasons quoted were lack of institutional architecture in local areas that could ensure supply of GIFT fingerlings, provide technical knowledge and purchase multiplied fingerlings. (See Figure 3)

After realizing these, RDRS and its partners through the RIUP initiative tried to develop necessary actor architecture. They promoted few table fish growers (pond owners) in different regions as 'satellite brood rearers' (suppliers of GIFT brood fish to interested rice-field farmers). Few educated and unemployed youth from local areas were promoted as field technicians to provide motivation and technical knowledge, and clarify doubts for interested farmers to practice DSP. They also helped DSP practicing farmers to adapt the technology to suit to their specific situations. The size and shape of the ditch in the rice plots, species of fish cultivated, feed provided, etc. were adjusted to fit to individual farmers' situations. The World Fish Centre representatives and personnel from the Department of Fisheries (DoF) helped these field technicians through technical backstopping. The IDE, which had expertise in developing rural markets, designed and implemented activities to develop local markets for fingerlings, to build relationships

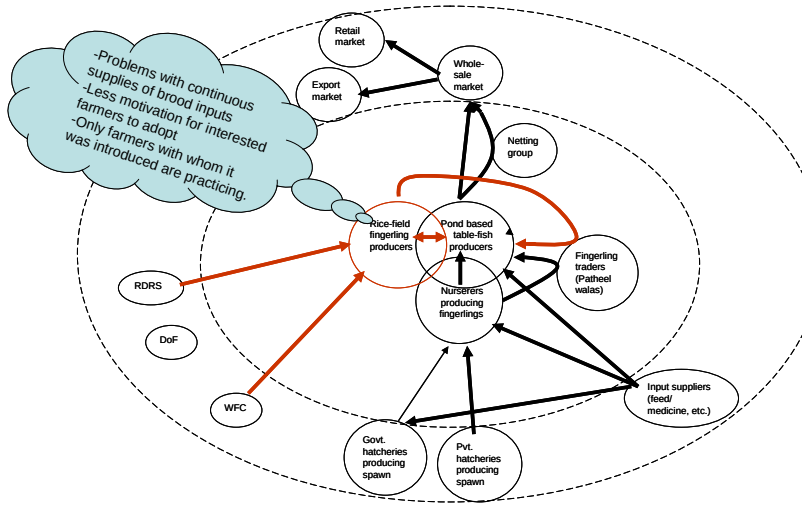
among different actors of the fish-seed value chain including – local fingerling traders, nursery growers, rice-field fingerling producers, table fish growers, input suppliers, etc. A “brood bank” was promoted, managed by the Department of Fisheries, for sustainable supply of brood stock to satellite brood rearers. Some local entrepreneurs were identified from fingerling traders, rice-field farmers and table-fish growers and they were provided with necessary knowledge and skills to promote the concept and get benefited by increasing their own businesses. Such architecture of agencies where every individual member has their personal mandates met through the collaboration, is contributing for large-scale adoption of DSP.

Discussions with participating agencies clearly indicated that such actor architecture was essential for promoting DSP.

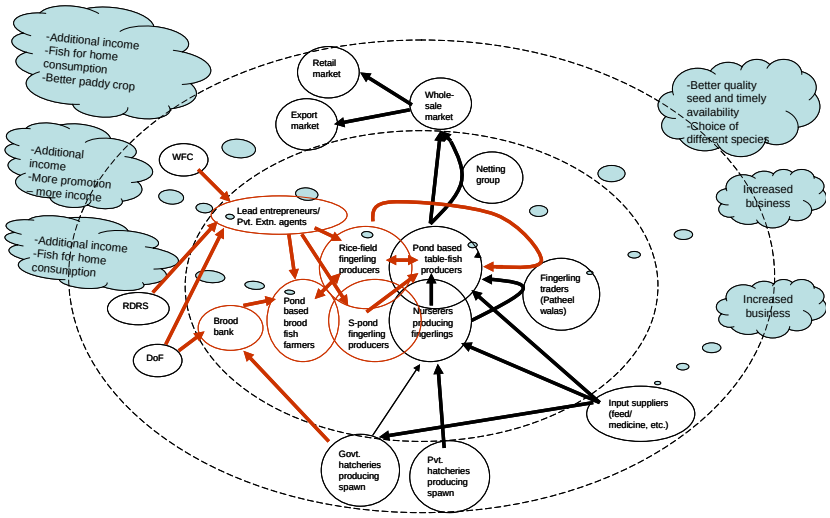
Figure 3. Different stages of stakeholder architecture in promotion of DSP



Situation 1: Relevant actors and their relationships – Starting conditions in the innovation trajecrtory



Situation 2: Relevant actors and their relationships – DSP introduced in individual farmers' fields



Situation 3: Relevant actors and their relationships – DSP introduced by creating appropriate architecture of stakeholders

4.2 Roles played by different types of agencies during different stages of innovation trajectory

These cases seem to indicate that different types of agencies assume lead roles during different stages of innovation trajectory. All these lead agencies play their roles while embedded in appropriate configurations of agencies. However there is no formal transfer of responsibilities and it is a continuous process of knowledge generation, adoption and wide-scale promotion. During all these three stages, knowledge gets refined, further developed, adapted to fit to the specific situations and then gets adopted.

4.2a Different research agencies leading the knowledge development stage

Development of PMCA

The Papa Andina is a regional programme initiative by the CIP with activities spread in Bolivia, Ecuador and Peru. It started its operations in 1998 with the main aim of promoting betterment of low-income potato farmers. Their initial activities focused on improving production and productivity through technological solutions. This approach did not succeed as marketing problems plagued any improvements in production. In order to address this situation, they began exploring ways to improve participation of small-holder farmers in the market chains. (Douglas Horton et. al., 2009) They joined hands with another initiative of CIP in Peru called Project for Potato Innovation and Competitiveness in Peru (INCOPA Project) with similar objectives and started using Rapid Appraisal of Agriculture Knowledge Systems (RAAKS) methodology developed by Engel and Salomon (2003) in the context of market chains. During this process they used RAAKS in conjunction with other participatory approaches such as rapid market assessment and focus groups. This gradually evolved into a new approach called PMCA (Douglas Horton et. al., 2009; Bernet, Thiele and Zschocke, 2006) and was successful in meeting the objective. Through application of this approach, relationships among market chain actors and R&D professionals were improved and triggered the development of new products. In 2003, when the INCOPA market chain work was reviewed in an Andean regional workshop, participants from Bolivia became interested in the approach and decided to begin experimenting with it at home. Over the next few years, the PMCA

was further developed and documented based on the work in Bolivia and Peru (Devaux et al., 2009).

Development of DSP approach

Two parallel streams of knowledge development one anchored by research oriented development project personnel and the other by researchers in collaboration with development programmes have contributed for the development of DSP approach.

Subsequent development projects such as NFEP (1988-2000), Interfish (1995-2000) and Go-interfish (2000-2005) tried fish cultivation in rice-fields and advanced knowledge. (See earlier section for more details)

Research efforts of a collaboration of Asian Institute of Technology (AIT), Worldfish Centre, Institute of Aquaculture of the University of Sterling, UK worked with local government departments and NGOs to advance technical aspects of developing appropriate hatchery system for low cost freshwater fish. As a result, technologies for tilapias in both commercial and small-holder situations, small carps and snakeskin gourami were developed or refined. Through their Aquaculture Outreach project, they promoted improved availability of quality fish seed for farmers and explored different approaches to suit different conditions. During such efforts, the importance and usefulness of seed production by farmers or seed production with greater involvement of farmers was established. Subsequently a research project on "Improving fresh water seed supply and performance in smallholder aquatic systems in Asia" clarified many perceptions and further advanced the knowledge about freshwater fish seed production in Asia. More importantly, this project further elaborated the relevance of DSP approach in the area.

Development of the multi-pronged approach for promoting UC

The knowledge base that resulted in development of the multi-pronged approach seems to have come from many independent research efforts.

One group of efforts are led by ICUC. In the initial stages, their initiatives were focused on collating local and scientific knowledge on production and post harvest aspects of UC into extension literature and promoting wider dissemination of such material. They

promoted regional networks such as Underutilized Tropical Fruits in Asia Network (UTFANET) and Southern and East Africa Network for Underutilized Crops (SEANEU) for this purpose. Through projects such as Fruits for the Future Programme, they worked with national research institutes and developmental partners for production of extension literature and organizing training programmes to disseminate them. During this period, they realized that making the knowledge available addressed only one aspect of the problem. There were other constrains for promoting UC, such as – lack of free access to plant propagation material of required species; unavailability of post-harvest and processing technologies; and lack of linkages to markets and other service providers. The need for broader engagement with diverse stakeholders was established.

Subsequently they implemented a project on "Improved livelihoods through the development of small-scale fruit processing enterprises in Asia" (RNRRS-8399), in which capacities of local partners were built in the production and processing of UC. These local partners were then expected to promote potential entrepreneurs to set up production and processing facilities, so that producers of UC benefit from these. In India, BAIF which was the local partner for ICUC, established three fruit processing facilities through Self Help Groups (SHGs) of small entrepreneurs and called them as resource centres. However these fruit processing enterprises collapsed, after initial success. The main reason identified was the lack of business skills by these small entrepreneurs to access credit facilities, markets and raw material.

These advancements in knowledge formed the base for planning a multi-pronged approach for covering all aspects of the problem.

Other independent research initiatives such as the 'Wambui' Project in Kenya (RNRRS-R7425) which enlarged the knowledge about packaging of information material for up-scaling; the work of Vinning & Moody (1997), which highlighted the problems faced by small-scale entrepreneurs; and the research project on 'Farmers' Organizations for market access' (RNRRS-R8275), which created better understanding of farmers' organizations' (FO) problems and conditions required for their success, also contributed for advancement of knowledge.

4.2b Field implementing agencies leading the knowledge adoption stage

The PMCA

The PMCA was originally developed in a completely different geo-political-cultural-market context than Nepal and for a different commodity. The IDE-Nepal tried to adopt it to local context and promote it. They collaborated with the key personnel associated with development of this approach to understand the conceptual underpinnings of the methodology. They realized that the three stages of the approach could provide opportunities for interactions among different agencies of any value chain, and their current constraint of lack of trust between farmers and traders could be easily addressed by such interactions.

With this expectation they implemented the approach in the actor architecture that was already established through RPI and SIMI. Different activities, which had potential to increase interactions and build trust, were implemented during the three stages of the approach. The focus was on joint planning and action. Activities such as rapid market appraisal; trainings on grading, crop calendars and market oriented production planning; and exposure visits to explore larger markets were included. The Thematic Groups were promoted as mechanisms for local stakeholders to have interactions and plan activities. The final events in each stage were used to bring together line departments and other agencies to showcase their activities. In essence they were using different components of PMCA for improving their specific situations for achieving their targets.

The IDE fully led this process of adaptation and adoption of PMCA. After successfully adapting and implementing this approach, currently IDE is planning to develop a manual to be used by DoA to scale-up/out the approach in other areas of Nepal.

The DSP approach

The DSP approach was developed in the same region with appropriate participation of farmers and other agencies. Hence significant adaptation was not required. However for this knowledge to be adopted, appropriate configuration of agencies needed to be created. RDRS and its partner organizations promoted this architecture. The NGOs who led the adoption phase of the innovation, worked with rice-field farmers, table-fish farmers,

seasonal pond owners, and fingerling traders to bring them together and promote their participation in implementing the approach. The IDE simultaneously developed the market and strengthened linkages among different value chain actors. The World Fish Centre and the Department of Fisheries provided necessary technical backstopping in the whole process. In the whole process, NGOs were playing the central role by coordinating with different agencies, ensuring information sharing, planning and execution of plans aimed at adoption of the approach in the area.

The multi-pronged approach for UC

The BAIF, which was anchoring the adoption of this approach, played a central role by bringing relevant agencies – such as technical experts, market players and community members – together for promotion of UC. They implemented this approach in their well-established *Wadi* program. Though the initial plan was to organize VCF as a large event by inviting all stakeholders from one region together, they later changed it to many small local events where local stakeholders participate. This was based on experiences from first stage activities. FPP were also decentralized. After first round of activities they encouraged local value addition before pooling at the central facility. Many such adjustments were made to the initial plans, based on feedback after first round of activities. After these experiences, they have a refined methodology, which they are promoting in a large area.

4.2c Private enterprises leading the scaling up/out stage

In all the three cases, it is clearly evident that the scaling up/out stage is led by private enterprises with complete business interests.

In the case of promotion of PMCA, traders have a strong business interests to collaborate in the program, as they are accessing larger quantities of good quality vegetables in graded form. By associating with this initiative their business is growing and now they are planning to explore larger national and international markets. In order to improve their business, they are providing information about preferences for produce in higher markets. While doing this, they are helping farmers to plan market oriented production. Encouraged by higher returns, farmers are increasing their vegetable production and meeting the quality requirements. The input dealers and other consumers are participating

in the initiative to improve their businesses and in the process contributing for expanding the initiative. Some vehicle owners in local areas are looking for collaboration, when the volumes increase. They are planning to work with the TG and help traders transport produce to distant markets and make money. All these stakeholders want the TG to be continued, as it is a platform where all these people can come together and participate in the collaboration.

In case of the multi-pronged approach for promoting UC, the VAPCOL, which is the apex body of the producers' company promoted by BAIF for its *Wadi* program, is spearheading the initiative. Since it has an elaborate network of processing and marketing facilities where UC are being promoted, it is ensuring purchase of UC produce from farmers. Their elaborate market network is enabling sending the processed UC produce in to the market and in turn offering better prices for the UC farmers. At the local level, private agencies such as the ones involved in horticulture nursery business are participating in the CGO initiative and supplying good quality planting material, and in turn contributing for enhancing the initiative. The VCF have become a mechanism for different private entrepreneurs to participate and promote their businesses and in the process promote UC. All these agencies are promoting continuation of the project initiatives in their personal business interests. Farmers who produce UC on degraded lands are benefiting due to such enhanced efforts.

In case of the DSP, the rice field farmers are making additional money with minimal adjustments to their rice plots and little additional investments. Some of these people also have farm ponds. Such people are selling fingerlings and releasing some of them into their ponds and then selling the table fish. The table-fish farmers who were promoted as satellite brood rearers, are making additional money by selling GIFT brood fish to rice-field farmers. Their existing table-fish cultivation is not affected by this initiative. They are trying to promote rice-field fingerling production, as they can sell brood fish to those farmers and make more money. The fingerling traders are benefiting by accessing good quality fingerlings at local areas and at better price. They are also promoting rice-field fingerling production, so that they can access more fingerlings and increase their business. Some large business enterprises are looking at this opportunity and are planning

to enter decentralized seedling production business. If it happens, it would further enhance the positive impacts.

5. Conclusions and implications

The initial stages of innovation process in agriculture value chains seem to be about creation of appropriate configuration of agencies and necessary social engineering. This creates demand for specific new knowledge and also creates an enabling environment for application of new knowledge. This has implications on planning projects that are aimed at putting knowledge into use.

Different types of agencies assume lead roles during different stages of the innovation trajectory for agriculture value chain innovations. Development partners or non-research partners assume lead role in putting knowledge into use. However they continue to be embedded in a multi-actor architecture which allows refinements to the knowledge to adapt it to local conditions. Private entrepreneurs play an active role in enhancing the efforts, in their personal business interests, and contribute for scaling up/out.

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