WHEN INNOVATIONS ARE NOT ENOUGH:
Lessons in Facilitating Innovations from an R&D Perspective

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ABSTRACT

CIP-UPWARD supported the use of participatory R&D approaches to facilitate experimentation and innovation for improving livelihood systems in Central Luzon, Philippines. Multi-agency partnerships implemented community appraisals, agricultural systems analysis, farmer field schools and farmer participatory researches. Technical and socio-economic evaluations were conducted to determine contributions of projects in local people's livelihood systems.

The results indicated the role of participatory approaches in facilitating project outputs and outcomes. PR&D approaches intensify awareness of research and development institutions about livelihood problems and opportunities and the potential of some innovations in solving them. Local government units, national government agencies, regional and provincial colleges and farmers' cooperatives provided their own resources to so that their constituents will benefit from innovations. They build infrastructures, finance capacity building efforts and mobilize communities. Unfortunately, a number of technical, socio-economic and policy issues limited more widespread use and greater contributions of innovations in improving livelihood systems of households in the region.

CIP-UPWARD initiatives on the development and dissemination of clean planting materials and on the use of sweet potato residues for improving backyard cattle fattening illustrated these experiences. Lessons from these experiences prompted CIP-UPWARD to downplay its role in assessing and facilitating technical innovations and oriented its goals towards strengthening partnerships, influencing markets and policy-making, and understanding impact areas beyond adoption rates.

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Introduction

Among poor rural households, the strategies to pursue livelihood are often diverse and complex and not easily accommodated by the framework and methods of mainstream agricultural research and development. Under these circumstances, innovations developed by research and development (R&D) institutions have found limited applicability. R&D institutions are further limited by their mandate to engage in other activities aside from those that are related to the generation of knowledge and innovations. A number of these institutions ventured into participatory approaches and looked at these as constant sources of innovation necessary to manage rural livelihoods under a constantly changing environment.

The Users Perspectives with Agricultural Research and Development (UPWARD) was established in 1989 to make agricultural research and development more responsive to the needs and circumstances of users, particularly for rootcrop agriculture and food systems in Asia. It is a partnership program of the International Potato Center (CIP) that tries to put in place essential elements of participatory innovation development in their R&D activities. These elements evolved from UPWARD's own field-based experiences and from efforts by other organizations to develop a wide range of participatory approaches.

The program's research and development interventions are done within a knowledge system with components, processes and actors that are inter-linked and where innovations emerge as a result of participation and interaction among stakeholders. Approaches used are not only associated with perspectives and approaches that are multiple and diverse, but also with processes that are non-linear, iterative and cumulative. In the context of facilitating innovations to meaningfully address rural livelihood problems, basic elements were put in place as guides to identify essential components of an integrated research-development oriented project.

This paper will look at these various elements, how they have been operationalized within the project context and how they have contributed to achieving project outcomes and impacts. It will also look at the limitations inherent and external to the process and the constraints they impose in further adaptation and use of the resulting innovations. The paper explores the use of the following elements - problem-based agenda, impact-driven objectives, field-based action, user responsiveness, household orientation, livelihood systems framework, integration of scientific and local knowledge, interdisciplinary mode and inter-institutional partnerships, as touchstones for assessing processes of local innovation.

Defining Context of Innovation

Violent eruptions of Mt. Pinatubo in 1991, drastically changed the landscape and ecology of Central Luzon. The volcano spewed tons of pyroclastic debris and ejected tremendous amount of volcanic ash on and around the volcano. Lahar flows occurred repeatedly covering wide areas with thick lahar deposits (PHIVOLCS, 1992).

The eruptions severely affected crop production by destroying irrigation infrastructure, altering soil structure and limiting crop productivity. Lahar flows covered point sources of water in the mountains, filled riverbeds and irrigation canals with sand and gravel and ruined concrete irrigation canals. Fertile soils were covered with meters-deep lahar deposits that have high bulk density, low water holding capacity, poor nutrient supply and other characteristics detrimental to crop growth and development.

Sweetpotato was found to be better adapted to lahar than any other crop. Although initial growth and yield was not as superior as when grown under normal conditions, better crop management however unlocked the potential of the sweetpotato as an important source of livelihood in the region. Years after the eruption, villages in the region were able to recover and improve their quality of life by engaging in sweet potato-associated livelihoods

Addressing Demands for Innovation

Sweetpotato is grown in diverse agro-ecological systems in the region. It is part of a livelihood portfolio that consists of crop, livestock and off-farm related enterprises (Figure 1). Assessment of the system identified "camote kulot", lack of quality planting materials, low soil fertility and lack of control of the market as priority problems of sweetpotato growing households. The assessment also indicated opportunities to improve productivity of the system by optimizing use of the products and by-products of the crop. It also suggested more in-depth studies of the trading and marketing aspects along the sweetpotato value chain. The diversity in livelihoods and the different strategies pursued by the various stakeholders and households involved, offer an array of research and development opportunities that need careful consideration, evaluation and prioritization.

"Camote Kulot"

Sweet potato production in the region has been plagued by a complex virus disease locally known as "camote kulot" (curled-leaf sweetpotato). It is the term used by farmers to describe a diseased plant that shows physical deformities such as curling of leaves, mottling, yellowing of leaves and stunted growth. Infected plants were observed to dry up if it express symptoms at one week after planting and produce few and small roots

The disease has been causing more than 50% yield reduction and is reported to be responsible for the loss of "Bureau" – an important local variety with good and well-accepted agronomic characteristics. Yield reduction was attributed to the reduced production, translocation and absorption of photosynthates caused either by reduced leaf area (due to curling) hardening of stems and other still unknown physiological and biochemical disorders. The disease devastated large production areas and caused great economic losses to many farmers in the region.

Backyard Cattle Fattening

Livestock raising is an important component of the livelihood system of households in the region. Households raised cattle, buffalo, goat, native chicken, ducks and pigs. Households fatten cattle by tethering them in pasture areas for several hours a day for eight months to more than a year. The daily feed intake of the animals is supplemented by crop residues from sweetpotato, yam bean, rice and corn.

Under this practice, cattle obtained an average daily gain (ADG) in weight of 0.3-0.5 kg/day. Unfortunately, while the duration of fattening cycle under this system is long, the income generated by the household is low because of low live weight of the cattle at the end of the cycle due to low ADG. Innovations to improve the local feed system, feeding strategies and fattening management practices of cattle are necessary for increasing the potential of backyard cattle fattening as a source of livelihood in the region.

Facilitating Innovation

Farmer Field Schools were used as venues for farmer learning and facilitating innovations to improve productivity and sustainability of sweet potato-associated livelihood systems in the region. FFS offered an open, flexible, location-specific and farmer-oriented education. Field schools for learning sweetpotato planting materials was implemented in Bagac, Bataan in 2000. The pilot FFS for sweetpotato-based cattle fattening was conducted in Paniqui, Tarlac in 2004.

Learning curricula for field schools were developed by facilitators and resource persons from various institutions together with potential school participants. Field and technical guides were prepared after conducting agro-ecosystem analyses and problem-needs assessment. Curricula and guides were piloted and continuously reviewed and revised in the succeeding schools. From the technical guides, hand-outs were prepared in the vernacular as clamored by the participants.

Experimentation, farm record keeping, financial analysis, and other special topics that were found necessary were also discussed. Participatory research methodologies used in aid of learning such as farmer- managed experiments, field observations, discussions, cross visits, field trips and group dynamics were conducted. Project launching, field days, end of season evaluations, and review and planning workshops were used to increase awareness of other actors and stakeholders about learning process. All activities were designed and implemented according to farmers' needs and situations making the project flexible and adaptive to local situations.

Creating and Adapting Innovations

The process allowed adaptation of innovations according to farmers and other users' needs and capacities. The process of rapid multiplication of CPM was subjected to a number of innovative inquiries that fancied farmers imagination. Nethouses were made from resources within the reach of each household. Nethouse sizes and shapes vary - posts were made from bamboo and wooden poles; wooden, steel and wire pins were used to anchor the nets; zippers, buttons and wires were used in lieu of door frames. Aside from doing the sewing of the nets themselves, young women, housewives and children adapted nethouse operations in the backyard. Farmers experiment on

the color, size and use of nethouses, on the number of nodes that appropriate for rapid multiplication of planting materials, on the kind of media which cuttings will grow best, on nutrient requirements, etc.

Nethouse Innovations

One of the important structures in the propagation and/or maintenance of quality of clean sweetpotato planting materials are the nethouses. Clean materials are propagated inside these structures to prevent insect vectors from transmitting the disease. TCA has received financial support from various institutions for the construction of nethouses. It has four nethouses measuring 5 x20 m with funding support from TCA and PCARRD in 1998, CIP in 1999, and DA-RFU3 High-Value Commercial Crops Program in 2001.

Nethouses at the municipal level were constructed either as a project counterpart of the LGU or provided by the project as learning venues for the technology and for the community to start propagating clean planting materials. In Tarlac, the municipality of Sta. Ignacia was the first to build nethouses followed by the municipalities of Moncada and Paniqui, the two biggest sweetpotato producing municipalities in the province. Likewise, the Bilad Multipurpose Cooperative in Camiling put up its own net house with the intention of going into the business of sweetpotato planting materials production. Nethouses built by these municipal governments measure 5x5-m with either steel or wooden frames.

DA-RFU 3 funded the construction of cheaper and more manageable tunnel-type nethouses that were distributed to participating municipalities. Twenty farmers constructed nethouses from their own funds or from production loans provided by local governments. These were either bamboo-frame type or mosquito net-type nethouses. The types, location and owners of constructed nethouses are in Table 1.

Table 1. Nethouse innovations for rapid multiplication of clean planting materials of sweetpotato

Nethouse Type	**Institutional Management**			**Subtotal**
	R&D Centers	LGU	Private	
Semi-permanent (5x20m;steel frame;double door)	TCA –5	Balanga-1	Domingo-1	16
	DA-CLIARC-2	Moncada-1	BMPCI-1	
	CLSU-1	Paniqui-1		
		Sta. Ignacia-1		
Improvised (5x20m; wood or bamboo frame; double door)	TCA-1	Moncada-1	Bagac-4	6
Tunnel-type (2x8m; collapsible steel frame; zip door)	TCA-4	Gerona-4 (Bamban-4)		25
		Moncada-4 (Sta Ignacia)		
		Paniqui-4		
		Bamban-4		
		Capas-4		
		Bagac-1		
Mosquito-net type (2x6m; pole support; zip door		Balanga-1	Bagac-1	20
			Balanga-2	
			Sta Ignacia-16	

Community-Based CPM Production

CPM production was undertaken in 60 hectares of nurseries and multiplication farms. Activities were spearheaded by FFS graduates and/or members of farmer organizations. In Tarlac, CPM production is being pursued vigorously by the Sta Ignacia CPM Producers Association while CPM utilization is being promoted by the Sapang Primary Multipurpose Cooperative, Inc. There are also individual farmers who engaged in CPM production and/or utilization.

In Bataan, three groups of participants constructed their own nethouses and produced CPM mainly for their own planting material requirements. Stem cuttings from their storage root production farms were sold to traders from Tarlac or given away to friends and relatives.

Backyard Cattle Fattening

The pilot FFS was implemented in four villages of Paniqui, Tarlac and was attended by 24 farmers while the second FFS was attended by 51 farmers from six villages of Paniqui and from two villages of Moncada, Tarlac. The field school built on the households' existing backyard cattle fattening practices and introduced improvements mainly in the feed system, animal health and housing. A computer simulation model was used to develop nutritionally balanced feed rations from locally available feedstuffs. Efforts were directed towards improving average daily gains in weight and shortening the fattening cycle.

Table 2. Comparison of traditional and introduced practices for backyard cattle fattening in Central Luzon Philippines

Practices	**Traditional**	**Introduced**
Provision of shed or housing	No	Yes
Confined in fattening stalls	No	Yes
Cattle is dewormed	No	Yes
Cattle is injected with vitamins	No	Yes
Fed supplements regularly	Sometimes only	Yes
Fed cut and carry	Sometimes [in the afternoon]	Yes
Provided with water	Twice a day if tethered	3-4 times
Included urea / molasses in ration	No	Yes
Included salt in ration	Oftentimes if available	Yes if molasses is not available
Fed sweetpotato roots	Yes	Yes
Fed sweetpotato vines	Yes	Yes
Fed rice straw	Yes	Yes
Fed grasses	yes	Yes
Tether the animal all day	yes	No

Table 3. Percent utilization of supplement- crop residues and roughage

Nutrient Sources	Group 1	Group 2	Group 3	Group 4
Concentrates	14.71 %	10.22 %	9.67 %	10.25 %
Sweetpotato residues	14.66 %	26.47 %	21.88 %	16.35 %
Roughage	70.63 %	63.31 %	68.45 %	73.40
Total: (%)	100.00	100.00	100.00	100.00

Generating Outputs and Outcomes

Capacity Building

Field schools were implemented in three locations in Bataan and in six locations in Tarlac covering 22 villages and 8 municipalities. The schools trained 170 farmers and 17 agricultural technicians in CPM production and utilization. Farmers appreciated the nature of viral diseases and understood dynamics of disease transmission including concepts of vectors, reinfection and alternate hosts. More importantly, they acquired skills necessary not only to produce CPM for their own farms but also in making an enterprise out of it.

Agricultural technicians who were only previously exposed to rice production not only acquired knowledge on sweetpotato planting materials and root production but also skills in managing and facilitating farmer field schools. In addition, facilitators and resource persons involved in the process also strengthened their capacities in managing and facilitating participatory approaches.

Farmers association and cooperatives increased their confidence and competence in dealing with individuals and institutions to access resources and leverage policies supportive of their need to improve their livelihood system. They were able to access financial support to finance research and development activities, micro-credit support to undertake CPM production and amend policies of the Land Bank of the Philippines to accommodate costs of CPM for sweetpotato production loan.

The interventions initiate processes of building capacities of project participants to address other farming and livelihood problems. The experience of solidarity, self-organization and networking encouraged in the research process prepared farmers for engaging in more meaningful collective action.

Livelihood Improvement

CPM was produced and used by 117 farmers from 16 villages in Tarlac and 8 villages in Bataan.. Some farmers prefer to produce and use CPM to be on the safe side especially that market for CPM is not yet well established. They also gain additional income from the roots produced by the crop. Others produce CPM for planting in their own root production farms but also sell CPM.

CPM producers claimed that they were able to generate an estimated average net income of PhP14,215 per hectare of their CPM production farms. An average of 118, 458 cuttings were harvested per hectare at PhP 0.12 per cutting (if the buyer harvest the cuttings) and PhP 0.15 per cutting (if the owner harvest the cuttings).

Sweetpotato root producers benefit from the use of CPM due to reduced cost planting materials and also on reduced disease incidence leading to better yields. Farmers who bought CPM cuttings and multiply them to produce planting materials enough for his entire root production area save 33% on the cost of planting materials if they will be buying them all.

The new feed system for backyard cattle fattening was highly acceptable because it was developed or improved based on farmers' traditional practice which was qualitatively enriched to suffice animal requirements. Increased average daily gains were obtained due to improved feed system. There was a marked improvement from 0.3 to 0.5 kg ADG/day under traditional practices to an average of 1.44 kg ADG/day. In addition, livestock raisers adapted stock judging, sweetpotato chipping, housing and record keeping practices learned from FFS. Aside from promoting better animal health and nutrition, the new feed system, also provided better management alternative for farm wastes and/or crop residues which, if left unused, would only serve as pollutants. It efficiently converted weeds and crop residues into high value and nutritious meat product.

Table 4. Average daily gain (in kg) of cattle fattened by participants during the FFS

Group	**ADG (kg)**	**Age (yrs)**	**Initial Weight (kg)**	**Final Weight (kg)**	**Gain in Weight (kg)**	**No. of Feeding (days)**	*Ave. Feed* **Consumed kg/day**
Group 1	2.49	2.03	272.23	434.30	162.07	65.43	36.09
Group 2	1.66	1.72	228.19	344.95	116.76	70.33	30.44
Group 3	1.20	1.72	209.37	294.79	85.42	71.05	31.31
Group 4	0.65	1.51	213.90	248.73	34.83	71.29	28.69
Mean:	1.44	1.75	230.92	330.69	99.76	69.52	31.63

Enterprise Development

CPM production provided farmers in the municipality of Sta Ignacia a new source of livelihood. In addition, they were able to utilize previously underutilized rainfed lands for planting materials production. Farmers who are previously trying to cultivate these lands for rice production are getting better income from CPM production. Idle lands were now being utilized while available farm facilities were maximized (both for personal use or for rent/hire), providing them alternative sources of income and employment.

Although, they had experiences financial losses in previous attempts to produce and market CPM, they persistently learn the trade and are now making adjustments in the system based on their and other farmers' successes and failures. The LGU of Sta Ignacia is now on its sixth year of supporting this initiative.

Knowledge Enhancement

Approaches in facilitating innovations are based on learning by doing principles in which farmers and other actors conduct field activities to test and learn about crop management options under realistic conditions. Knowledge were gained through field experimentations, observations and discussions and supplemented with scientific and socio-economic explanations.

Farmers appreciated value of experimentation as they hop from one experiment to another during field schools. They even proposed to validate results of these experiments through farmer participatory research as they wanted results from bigger experimental plots

Dealing with Limits of Innovations

The number of farmers benefiting from CPM production and use was also limited by availability and accessibility of mother plants. Farmers in the region were very much dependent on TCA as a source of starting materials for CPM production. Assessment results indicate the need for more efficient production of mother plants and single node cuttings that will provide CPM producers flexibility in terms of the area and timing of production

Weather Uncertainty

Development and multiplication of pathogen-tested planting materials is not enough to ensure that benefits from its use will accrue to farmers and other users. Losses from CPM production occurred because the timing of planting was not adequately studied. The age of planting materials has a bearing on its performance and thus planting materials from a more than 75-day old crop will not anymore be bought by root producers. Coupled with uncertainty of weather conditions in root producing areas, probabilities that synchronous planting of CPM will result to financial losses are very high.

Lack of Quality Control

Ensuring quality of CPM is limited by the absence of production and distribution protocols which will serve as a guide to CPM producers/users to ensure quality production, limited capacities of non-FFS graduate farmers to undertake CPM production and non-strict observation of FFS graduates of the recommended SP CPM production practices prevented

Untrained farmers are also getting into CPM production to cash in on the economic benefits of the enterprise. Hence farmers could be misled in buying these poor quality planting materials and the resulting disillusionment of the unsuspecting buyers can kill the fledgling seed industry as well as local initiatives to improve seed quality

Crop Re-infection

CPM remained virus free only when grown in isolation. They quickly became infected when planted in the field. On farm experiments showed that yield of planting materials taken from the previous season's CPM crop can be reduced by more than 10%. In addition, even though CPM can reduce incidence of camote kulot and thus improve yield, factors affecting productivity of sweetpotato in the region are multi-faceted and dynamic.

Limited Options for Integration

Managing "camote kulot" alone necessitates reliance on other components of an integrated crop management strategy- resistant varieties disease management, nutrient management, soil and water conservation, etc. Even techniques of cleaning-up a variety needs to be done to other

varieties aside from “Super Bureau” so that chances of pest outbreak associated with monocultures of single variety will be minimized.

Varieties resistant to sweetpotato viruses and other pathogens are not yet identified if not developed. New pests such as sweet potato weevil, rough weevil, stem rot, scab army worm, and little leaf are becoming more important. Soil erosion and degradation also incessantly affect sweetpotato yields as farms are continuously to be intensively cultivated. The presence of any of these factors easily negates whatever impacts the use of CPM created.

Beyond Technical Innovations

Participatory approaches can help develop and adapt innovations to solve problems of farm productivity and efficiency of livelihood systems. However, complex production constraint such as “camote kulot” require’s more than technical interventions. CPM use may help reduce disease incidence and improve yield but these gains may not readily be translated into high income or better livelihoods. Prices of farm inputs and farm products are beyond farmers nor the research team’s control. The high cost of transport due to long distance of farms to main roads and absence of farm to market road increases cost of production.

Micro-credit, extension and marketing support are way beyond mandates of research institutions. But these concerns largely determine the nature and degree of impact that a technology like CPM can create. An inter-agency partnership is not an assurance that partners’ support will not be use to advance personal and/or institutional agenda.

Financial assistance needed by enterprises was provided by national agencies, local government units and/or rural banks through micro-credit. The system however was prone to financial opportunism. There were instances of non-repayment of loans as well as incidences of paid loans not being remitted back to funding institutions. There were loans being issued to people who did not even venture in the enterprise. A nethouse was built in an area where technical requirements such as access to water was not met. Nethouses and other facilities are also used not for the purpose that they were meant. Although the resources used were contributed by the agency, the events proved inimical to the outcomes of the project.

Revisiting Elements of Innovation

In the context of facilitating innovations to meaningfully address livelihood problems of poor rural households, basic elements of participatory research were put in place as guides to identify essential components of an integrated research-development oriented project. The research agenda was based on problems severely affecting farmers in the region for several years. More weight was given to underlying principles of experimentation and learning. Research tools and techniques were selected and curriculum was developed to ensure that they bring about maximum independent learning.

Interdisciplinary Team

Interventions were implemented by an interdisciplinary team coming from different institutions. Project processes recognized co-equal existence of the different stakeholders not only in the learning but also in the research and development process. Interdisciplinarity depended not only on professional expertise but also on personal chemistry. The inclusion of an agricultural technician from LGU as team member of FSS-SPBCF project boosted the enthusiasm and learning interest of participants. Since he himself is engaged in cattle trading and marketing, he brings in to the team an insider's view of the system. The project team and participants appreciated the fact that he did not hesitate in sharing secrets of the trade. Distrust among team members of FFS-SPPMP created frustration and a lot of missed opportunities for the project.

Knowledge Integration

The process effectively addressed different stakeholders expectations by integrating their issues and concerns expressed during discussions in the research agenda. The "camote kulot" problem although technically identified by researchers was considered urgent and important on the basis of farmers' perceptions elicited using participatory research methods. The control and prevention measures were designed based on farmers' situations determined through agro-ecosystem and livelihood systems analysis.

FFS provided venue for self-discovery linking local knowledge with knowledge generated from science. The field school curriculum was an output of the interaction of the interdisciplinary team that managed and implemented the project. In addition to this level of integration, it was further validated with the participants such that the learning agenda will be more relevant and appropriate to them. Constant interaction among the actors under conditions of cordiality and ethics or mutual respect made the process more effective.

Multi-Agency Partnerships

Multi-agency partnership is a critical dimension in putting into practice UPWARD's concept of local R&D management. It simply means making R&D responsive to local development needs by involving major stakeholders in the process and encouraging local institutions to offer inputs in a process which is driven by their needs.

The projects did not only encourage LGU's and other R&D partners to contribute more resources to the project but also enhance their capability and interest to take in other roles and responsibilities in the process. Collaboration and resource complementation were greatly improved as evidenced by the specific roles and responsibilities extended towards the success of the project. Partnerships consolidated the provision of support services considered important for sustaining sweetpotato associated livelihoods.

Impact Orientation

Attempts of projects to create impacts are stifled by limitations that are beyond limits of technical innovations. More attention can be given to the preparation of the community and other stakeholders to participate. Farmer organizations and cooperatives need to be strengthened to

engage the markets and pursue collective actions to have access and control over resources essential for sustaining innovation process. R&D processes needs to emphasize not only the functional but also the empowering aspect of participatory processes. In this case, there is a need to reconfigure composition of teams and partnerships by accommodating expertise in community organizing and multi-stakeholders' collaboration.

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