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Participatory research approaches for enhancing innovations and partnerships in soil productivity improvement

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Abstract

Agricultural production per unit area in Uganda has been on the downturn attributable to biophysical and socio-economic problems. The failure by farmers to manage these problems partly ensues from poor delivery of technical knowledge and inadequate institutional support. Traditionally, research was conducted on-station or through researcher managed on-farm trials and the government's extension system, using 'top-down' dissemination methods, transferred the results to the farmers. One of the major weaknesses of this approach was failure to involve farmers in testing and adapting technologies that suit their circumstances. Participatory approaches have therefore been adopted to adapt and promote generated technologies to make research effective and relevant to the farmer. This paper uses experiences of the Soils and Soil Fertility Management Programme (SSFMP) of the National Agricultural Research Organization (NARO) and its partners to illustrate the variety of participatory approaches used. These include, participatory on-farm trials/demonstrations, Farmer Field Schools and Participatory Development Communication. Where further experimentation is required farmer managed, researcher managed and Participatory Learning and Action Research on-farm research have been used. Besides farmers, the approaches involve national and international research institutions, extension agents and community-based organizations as partners. These approaches enhance farmer skills and knowledge and since everybody is involved in the process, indigenous knowledge and innovations are captured and integrated in the selected options. The methods and approaches have caused a multiplier effect through farmer-to-farmer and farmer-to-other stakeholder communication using tools, like posters, field days, traditional theater, among others. Utilization of these methods and approaches has not only enhanced the relevance of the research process and results but has also improved the uptake and utilization of these results, hence reducing natural resource degradation while increasing productivity.

Key words: Dissemination, natural resource degradation, Productivity,Technical knowledge

Introduction

According to Bessette (2003), poverty alleviation, food security, and environmental sustainability are closely interrelated and present major development challenges for all actors involved in the environmental and natural resources management fields. Regarding poverty alleviation and food security, agricultural production per unit area in Uganda has been on the downturn attributable to biophysical and socio-economic problems. On the other hand, environmental sustainability has been dogged by issues such as land degradation (declining soil fertility, soil erosion, overgrazing, deforestation, etc.) and poor management of water resources (siltation, water runoff, pollution loading, etc.). At the core of these challenges lie poor communities and households struggling to ensure their livelihood in the ever changing and unfavorable environment.

The failure by communities and households to manage challenges partly ensues from poor delivery of technical knowledge and inadequate institutional support. Traditionally, research was conducted on-station or through researcher managed on-farm trials and the government's extension system, using 'top-down' dissemination methods, transferred the results to the farmers. One of the major weaknesses of this approach was failure to involve farmers in testing and adapting technologies that suit their circumstances and thus the efforts have met with limited impact.

In that regard, approaches which involve farmers at all stages of research, have been adopted to adapt and promote generated technologies to make research effective and relevant to the farmer. These include participatory on-farm trials/ demonstrations (Mutsaers et al., 1997), Farmer Field Schools (Braun *et al.*, 2000) and Participatory Development Communication (Bassette, 2001). Where further experimentation is required farmer and researcher managed on-farm experimentation and Participatory Learning and Action Research [PLAR] (Defoer and Budelman, 2000) has been used. In addition to participatory approaches, partnerships have been developed, with development stakeholders working with the communities and Consultative Groups for International Agricultural Research (CGIARs), in order to build synergy and maximize impact.

Although each of the approaches and studies herein has specific objectives, the general objectives of these approaches and thus studies were:

i) to introduce the concepts of the participatory approaches in the communities;

ii) to use participatory tools and methods to characterize communities by diagnosing opportunities and challenges so that communities have a comprehensive understanding of their environment;

iii) to identify and adapt new farming practices and materials that will improve the production system and increase productivity and livelihoods in a sustainable way;

iv) to encourage farming communities to form groups according to their development needs for better land resource management at farm and catchment level;

v) to develop communication tools for facilitating communication among farmers about improved farming methods.

Materials and methods

The Soils and Soil Fertility Management Programme (SSFMP) started using participatory approaches in the early 1990s. The approaches have been used in different agro-ecological zones, stretching from the Mbale hillsides to the Rakai western hills and northwestern plains. Methods of each approach will be described in general terms and some concluded studies/ projects that were conducted using each of the approaches will be used to give explicit illustrations of the approaches, their development impact, and challenges.

Participatory on-farm research/ demonstration

In general, participatory on-farm research (POFR)/ demonstration has three components, the diagnostic component, which entails developing a clear understanding of the farm and its environment as well as the farmers' goals, challenges, and opportunities; the experimental component involves the choosing or designing appropriate innovations, in close-cooperation with farmers, and testing them under real farm conditions; and the evaluation component, which requires evaluating the performance of the innovations and monitoring their adoption, or analyzing the causes of non-adoption (Mutsaers *et al.,* 1997).

Participatory on-farm research/ demonstrations for soil productivity improvement were initiated by the SSFMP in collaboration with the National Beans Programme and the Center for International Tropical Agriculture (CIAT) in the early 1990s as an alternative to the traditional top-down approaches used by government extension services. Using participatory rural appraisal (PRA) tools, agricultural production and socio-economic opportunities and challenges faced by farmers were identified. The farmers ranked soil fertility among the major constraints to crop production in the study areas. Discussions were held with the farmers on possible technologies/ interventions. The farmers volunteered to test technologies of their choice. Two types of trials were initially conducted, researcher-designed but farmer-managed and those jointly designed by farmers and researchers, and later farmer-designed trials. Farmers' meetings were held during the season to plan seasonal activities and to get feedbacks from farmers on the performance of the technologies. It should be noted that right from the start, local leaders (LC 1 – 3) were deeply involved in the POFR.

A study conducted on a transect starting from Mt. Elgon to Lake Kyoga (Kaizzi *et al.,* 2002) will be used to give an explicit illustration of the POFR process. The transect captures variability in altitude, soil productivity, land use intensity, and agricultural potential, and covers four agro-ecological zones namely, the Lake Victoria Crescent, the Southern and Eastern Kyoga basin, Jinja and Mbale farmlands, and Mt. Elgon High farmlands (Kaizzi *et al.,* 2002; Wortmann and Eledu, 1999). Farmer managed on-farm Trials were set up at Agonyo II (Soroti district), Odwarat (Kumi district), Kasheshe and Nemba (Mbale district), Lubembe/Doho (Tororo district), Kongta (Kapchorwa district), and Nakisenye (Pallisa district). Demonstrations/ trials managed by researcher scientists were set up Bulegeni Agricultural Research Development Centre (ARDC), Mbale district and Kibale Technology Verification Centre (TVC), Pallisa district.

The trials and demonstrations were based on integrated nutrient management (INM) strategies, which entailed utilization of biological nitrogen fixation (BNF) through the use of velvet bean (*Mucuna* pruriens), either as a relay crop, or as an improved fallow and inorganic N fertilizers. The objectives of the trials/ demonstrations were to evaluate the maize yield response to inorganic N fertilizer, a preceding mucuna fallow, and a mucuna relay crop on contrasting soils (Kaizzi *et al.,* 2002).

The Farmer Field School approach

The basic principles of the Farmer Field School (FFS) approach are to empower farmers to be technical experts on major aspects of crop and livestock production; improve the farmer decision-making capacity; and stimulate local innovation (Braun *et al.,* 2000). The approach also aims at integrating experiences and knowledge of the farmers with research and extension to stimulate technology adaptation and adoption. The FFS approach varies from the participatory on-farm research in that it provides a more traditional teacher-student and interactive setting for learning about knowledge held by outsiders (Braun *et al.,* 2000). A school curriculum is designed to provide basic agro-ecological knowledge and skills but in a participatory manner so that farmer experiences are integrated in the learning process. The schools are coordinated by a facilitator, who meets with the farmers regularly (at least once a week) in the farmers' communal gardens. During these meetings planned field activities are executed, agro-ecological observations made, and interventions to emerging issues discussed. In addition to the FFS curriculum, special topics regarding the farmers' socio-economic concerns are addressed.

In a Technical Cooperation Project (TCP) between FAO and NARO to pilot conservation agriculture (CA) for improved land management and livelihoods of smallholder farmers, a FFS approach was adopted. This approach was preferred over the POFR because even though the principles of CA are new to the people of Uganda, the practices are not new. Therefore the project required an approach which provides a teacher-student setting but taps the experiences and knowledge of the farmers as well. Secondly, CA has no panacea, therefore requires a lot of innovations on part of the practitioners which is part and parcel of the FFS approach.

The pilot project which was conducted in four parishes in Pallisa and Mbale districts had a total of 16 FFSs. Activities in the schools included developing action plans, general and executive meetings, gardening, field observations and data collection, and studying and special training. Participation in these activities by group members was monitored through attendance lists. Through their field schools, the farmers made observations on the performance of maize, beans, and soybeans under conventional tillage methods, minimum tillage, and improved fallows using different leguminous species. They also made observations on the performance of perennial cropping systems using integrated soil and water conservation strategies, such as mulching, contour bunds, water retention channels, and cover crops. Field problems and successes were observed and analyzed from planting to harvest. The group decisions on crop management were evaluated at the end of the season by measuring the crop yields.

The project had a 16-member Project Steering Committee (PSC) for monitoring and evaluation processes. The PSC comprised of district civic and political leaders, FFS District Coordinators, FFS Network Coordinators, NARO research scientists, and Makerere University, FAO, and Africa 2000 Network representatives.

Participatory Learning and Action Research (PLAR)

This approach combines some aspects of participatory on-farm research and the Farmer Field School approaches. Like the POFR process, the PLAR approach allows farmers to identify their agricultural production and socio-economic opportunities and challenges using the PRA tools. However, the point of departure is that, unlike POFR where in most cases the experiments are designed by the researchers but managed by the farmers, in PLAR the farmers are allowed to design and manage their own experiments. Similar aspects between the PLAR and FFS approaches include tapping farmers' experiences and knowledge and allowing innovation on part of the practitioners.

The SSFM programme in collaboration with the Centre for International Tropical Agriculture (CIAT) used the PLAR approach in a study on integrated nutrient management strategies in eastern Uganda (Esilaba *et al.*, 2002). During the diagnosis and characterization phases of the PLAR process, farmers analyzed soil fertility management diversity and resource endowment among farms in Buyemba, Kavule, and Magada villages of Imanyiro sub-county, Iganga district. Household characteristics of the farmers were determined by a diagnostic survey of 140 randomly selected farmers from the participating villages.

Regarding on-farm experimentation, 20 farmers representing three soil fertility management classes, in the three villages, were chosen as test farmers for intensive monitoring of the on-farm experimentation. The selected farmers drew resource flow maps for analysis of their current soil fertility management practices and to identify possible improvements and made a planning map (Budelman and Defoer, 2000) which entailed the crops they intended to grow and seasonal activities. The farmers designed 11 experiments and proposed the data and procedures for monitoring and evaluation. The experimental design of the 11 trials varied from a minimum of two treatments to a maximum of five treatments.

Participatory Development Communication (PDC)

Traditionally, interventions to natural resource management constraints required development packages. However, if at most the packages were put to use (adopted), there were no mechanisms to take information regarding the packages beyond the farm or community where the interventions were made. In contrast, the PDC approach underscores the use communication as a tool for development and entails several mechanisms for disseminating information among various stakeholders.

Like all the other participatory approaches, PDC involves the use of PRA tools/ techniques to identify agricultural production and socio-economic opportunities and challenges. However, unlike some participatory approaches the PDC activities are as a rule-of-thumb group-based. Therefore, after identify and prioritizing the opportunities and challenges, community groups are formed according to the identified challenges. The community groups are then facilitated to develop participatory action plans which entail identification of communication needs, objectives, activities to achieve the objectives, and tool to execute the activities.

Community groups are further facilitated to design and develop communication materials such as brochures, posters, songs, poems, and drama addressing topical issues of the identified challenges. Furthermore, farmers are facilitated to organise farmer field days where they make exhibitions about the technologies and the outcomes of the technologies. All these modes of communication are designed for the farmers practicing PDC to disseminate to other farmers technologies that alleviate environmental and natural resource management constraints in order to increase crop productivity and thus improve rural livelihoods.

In a study on communication among banana growers for improvement of soil and water management a PDC (Bassette, 2003) approach was used. The study, conducted in Buyamba, Ddwaniro, and Kayonza parishes of Dwaniro sub-county, Rakai district, received financial and technical backstopping from the International Development and Research Center (IDRC). A team comprising of a soil scientist, socio-economist, site knowledge specialists, communication expert, and farmers implemented the study. After the PRA exercises, three community groups concerned with identified constraints were formed. Suggestions to further stratify the community groups either by gender, wealth category, physical disabilities, or any other socio-economic characteristics was not entertained by the farmers.

Participatory development of methods for combining scientific and indigenous knowledge for land improvement

This work utilised participatory approaches to combine indigenous with scientific knowledge in developing a comprehensive programme for sustainable land productivity. In Katakwi district (Tenywa et al., 1999), farmers were involved in problem identification, generation and dissemination of new soil fertility and water management technologies. Diagnostic PRA tools were used to explore farmers' knowledge and perceptions about their soils.

Results and discussion

Participatory on-farm trials/ demonstration

Participatory on-farm experimentation gave farmers an opportunity to evaluate crop response to alternative soil nutrient replenishment and conservation strategies. Apparently, farmers observed that maize yields increased significantly ($P = 0.05$) with either application of inorganic N fertilizers, or under a preceding mucuna fallow, or relay as compared to the common practice of continuous maize without any input. Therefore they concluded that inorganic N fertilizers and mucuna green manures served as effective N sources for maize (Kaizzi *et al.,* 2002). However, on ranking the alternative N sources for maize production, mucuna fallow was ranked the highest. Although maize responded very well to the inorganic N fertilizers, the farmers cited the high costs as a deterrent to the use of these fertilizers. Similarly, relay cropping mucuna with maize was not a favorable option because it introduced another activity of physically removing the climbing mucuna vines from the maize to prevent the mucuna from smothering the maize crop.

Evidently, the POFR process gives farmers an opportunity to test and adopt technologies that suit their circumstances. In this study, the farmers were able to evaluate the technologies and made an informed decision [from their on-farm trial observations] about the technology they wanted to adopt. With the old methods of technology generation/ dissemination, since farmers were not involved in the development, testing, and adapting the technologies, they failed to identify with them and as a consequence adoption rates were usually very low. Sometimes because there were no practical learning experiences, the technologies were considered too theoretical or out of reach by farmers. However, in the new approach, farmers are empowered to own the technologies because they are practically involved in the process of developing them. In regard to dissemination, it becomes relatively easier for other farmers to adopt the technologies when they see the crop responses in trials managed by their fellow farmers, whom they can identify with other than researchers or extension agents who are considered to have immense resources and technical knowledge. Furthermore, the POFR process empowers farmers with skills for technology evaluation, thus enabling them to continue with the evaluation process.

The Farmer Field School approach

The appropriate number of participating farmers in a FFS is 25 to 30. The high number of participating farmers has the advantage of bringing in a lot of local experiences, indigenous knowledge, and innovations to the learning process. Furthermore, each of the 25 to 30 school participants is a potential adopter of the practiced technologies. In the CA pilot study, after two seasons of attending the FFSs many participants had set up individual plots where they practiced the principles of conservation agriculture using their hands-on training from the FFSs. Evidently, the approach ensures a high adoption rate and has far-reaching multiplier effects

On the other hand, since it involves many farmers drawn from a catchment, the approach has across-the-board impact regarding natural resource management. The traditional methods of information dissemination targeted individual farmers and the operations were farm-level based. However, with the FFS approach a whole catchment could be involved and issues regarding the environment are tackled with a catchment perspective. In the Mbale hillsides, before the pilot project, a few farmers were managing water runoff in their fields by constructing contour water retention channels. However, the channels were often washed away and therefore the farmers' efforts were of little impact as long as their neighbors on top of the hills were not involved in the practice. With the FFS approach, this problem has been reduced considerably because many farmers in the catchment have taken on the practice of constructing channels. In addition, some of the arduous tasks like construction of the water retention channels on very steep slopes were taken on as a group rather than as individuals. The group approach to implement interventions also enhances the implementation success and adoption rate.

The schools also offer a critical mass that can lobby for support from local governments and non-government organizations. In one of the Project Steering Committee meeting, the farmer representatives on the committee requested the Secretary for Production of Mbale to forward their request to the District Council for a byelaw that would require every resident in the hillsides to construct water retention channels. With the advent of the National Advisory Services (NAADS) the FFSs will again use the critical mass to demand for services.

Generally, the FFS approach ensures sustainability long after the project has ended because the participants act as a support group among themselves to carry-on with the new practices and could also act as watchdogs to ensure that community activities are compliant with the principles of natural resource management.

Participatory Learning and Action Research (PLAR)

Using the PLAR approach, farmers diagnosed opportunities and constraints in Buyemba, Kavule, and Magada villages of Imanyiro sub-county, Iganga district (Esilaba *et al.*, 2001a). Among the identified constraints was poor soil fertility management. However, management was variable; therefore three soil fertility management classes were identified. Farmers using interventions such as green manures, inorganic fertilisers, agro-forestry, fallows, compost manure, etc. to address the problem of soil fertility decline were categorised as Class I, those using only one or two of the interventions were categorized as Class II, while those not using any of the interventions were placed in Class III. Members from each soil fertility management class conducted on-farm experiment on their farms.

At the end of the on-farm exercise, farmers in Class I had implemented more experiments compared to Class II and III (Esilaba *et al.*, 2001b). Apparently, the Class III farmers did not implement the experiments due to the very small land holdings, limited household labour, and lack of disposable cash and inputs.

This study and approach highlighted the fact that soil fertility management is related to the farmer's resource endowment. Thus different farmer groups have different needs and capacities that require different practices and technologies (Esilaba *et al.*, 2002). By letting the farmers to design their experiments and deciding on the data to collect, the approach inculcated a research spirit in the farmers.

Participatory Development Communication (PDC)

The farmers from the three participating parishes identified declining soil fertility, moisture stress, and soil erosion as the major constraints to banana production. When farmers are involved in identifying the agricultural production constraints, the interventions to address the constraints, and communication mechanisms for reaching other farmers who might be facing similar challenges, it empowers them to be advocates of the technologies being promoted. Furthermore, the PDC approach ensures rapid adoption of technologies because the farmers become extension agents in their own right and just by their sheer numbers could reach far many other farmers compared to one sub-county extension agent. The traditional extension system in Uganda has a farmer to extension agent ratio of about 5,000 to 1, which is very limiting.

Generally, the main objective of each community group was to increase banana productivity and quality so as to attain food and income security. While specific objectives of each group had something to do with alleviating the group's identified production constraint. However, each group lacked the skills and knowledge to implement the identified interventions. In that regard, skills, knowledge, and information were identified as the most pressing communication needs and the activities to address these needs were training, sharing information, and exchanging visits within and outside the sub-county. The communication tools identified were print-type [brochures and posters], audio and visual [radio programs and video], theater [songs, poems, and drama], and exhibitions [farmer field days].

The approach also addresses the question of message appropriateness. When designing their communication materials, farmers used objects that they were familiar with and also used a farmer-level language. Therefore the farmers who were to benefit from the communication materials could easily identify and conceptualize the issues at hand unlike if the materials had been designed by research scientists. Farmers as extension agents are also likely to be more convincing to their fellow farmers than scientists. This stems from the fact that sometimes the scientists are not practicing agriculturists and their arguments with the farmers might sound more academic than practical. Like the FFS approach, the PDC aspect of group work, helps in realising a critical mass that could be used to lobby for services and take on arduous tasks that would otherwise be impossible to implement.

Participatory development of methods for combining scientific and indigenous knowledge for land improvement

Farmers classified their soils primarily on the basis of their location along the landscape (low lands, backslope and upland) and secondly on the basis of their properties (e.g. texture, colour, workability). Depending on their limitations, each soil type was suitable for a particular use (e.g. building, cultivation, etc.). The identified soil units were then geo-referenced using a GPS, sampled and analyzed, and hydraulic and infiltration field tests carried out.

There was good agreement between the farmer-identified soil units and those obtained scientifically (Tenywa et al., 1999). Working from the farmers' existing practices and coping strategies for moisture stress and soil fertility management, relevant entry points were identified for farmers to test a range of potential options. Through a participatory assessment of the benefits and weaknesses associated with different options, farmers were able to select soil management options of their choice.

Challenges

Natural resource management in itself has a lot of challenges, the major ones being the extra financial and labour inputs. However, even when farmers could afford the extra resource inputs, the fact that most benefits from NRM investments are long term is a deterrent in itself. The participatory approaches help to sensitize stakeholders, particularly farmers, about these challenges.

However, just like any methodology, participatory approaches are not challenge-free. Some of the non-methodological challenges are the large amount of resources required to establish farmer participatory research sites and the limited resources that curtail scaling up/ out. One of the methodological challenges that often beset these approaches is changing the mindset of all the stakeholders from using the top-down approach to the participatory one. It was evident in most of these approaches that, much as it is difficult for the research scientists to change the status quo it is even much harder for the farmers, extension agents, NGOs, and local government staff to change their mindset regarding their roles. With the top-down approaches, farmers are at the receiving end all the time therefore it is hard to convince them that they have some valuable knowledge to offer. This challenge has been overcome by slowly building the confidence of the farmers and the trust between the researchers and the farmers. Some of the tactics used to achieve this have been interaction with the locals, encouraging them to share their experiences, acknowledging their vast knowledge, and appreciating their indigenous technical knowledge.

On the other hand, extension agents, NGOs, and the local government staff have never been at the receiving end, especially in regard to dealing with the farmers. They are used to dispensing panaceas and therefore find the participatory approaches painstakingly slow. In the new approaches there are no panaceas. The farmers need to be involved in the process of identifying solutions to the NRM problems; this therefore requires bringing them nearly at the same level of understanding and performance as the other stakeholders which is not a small feat. To overcome this challenge stakeholders have to learn the virtue of patience and to appreciate contributions from all stakeholders at all levels.

Another methodological challenge is maintaining a high participatory spirit among the farmers in order to reduce the rate of turnover. In this regard, frequent visits by researchers are necessary especially during the early stages of project implementation. Other means for reducing turnover are by encourage farmers to form farmer participatory committees with an executive responsible for the daily running of the activities, and having village based facilitators identified among the participating farmers. The facilitators assist farmers who join the participatory activities later and also act as links between the researchers and the farmers. Regarding group dynamics, challenges include sustaining scientific backstopping for weaned groups, sustainability of groups' focus on NRM, i.e. there could be other pressing issues other than NRM.

On the social front, although women in Uganda are in most cases the architects of development in agricultural enteprises, there are serious challenges that could marginilise this section of the community. These include the issue of women who cannot talk before big gatherings especillay for fear of contradciting men; for husband and wife who should attend the meetings with research teams?; long distances between homesteads and the meeting venues; and the timing of the meetings. Regarding 'silent women', approaches/ tools that encourage disadvantaged groups to participate in discussions should be employed. Otherwise, various social groups should be encouraged to meet separately and tease out their ideas and where this is not possible, possibly due to long distances and the timing of the meetings, the research teams should meet the women one-on-one at their 'duty station'- the kitchen. A daily calender is a tool in PRA which can be used to show work distribution between gender. The calenders helped some men to realise that women were overworked and there was a need to share the load.

Partnerships

Since no single institution can meet all the challenges in research and development and due to the participatory nature of the new approaches there is a need to develop partnerships with other development stakeholders working with the communities. This has been done to build synergy and maximize impact. The SSFM programme collaborates with a number of national organisations, mainly Makerere University, Ministry of Natural Resources, National Environment Management Authority (NEMA), and with non government organizations (NGOs) such as Africa 2000 Network Sasakawa Global 2000, and Appropriate Technology (Uganda) [AT (U)]. Furthermore, the programme has received technical and sometimes financial backstopping from international organisations, such as IDRC, Rockefeller Foundation, CIAT, and Tropical Soil Biology and Fertility (TSBF) regarding understanding and implementing the participatory approaches.

Other regional and international organizations the programme has linkages and collaborative activities with, regarding participatory research, are the Food and Agriculture Organization (FAO), International Atomic Energy Agency (IAEA), International Centre for Research in Agro-forestry (ICRAF), African Highlands Initiative (AHI) and the Natural Resources Systems Programme of the Development Fund for International Development (DFID), through the University of East Angelia.

Conclusions

Evaluations to estimate the impact of these approaches on the rate of technology adoption and the overall goal of rural livelihood improvement are still underway. But one thing is for sure, these approaches have empowered the farmers to own the research process and the outputs. Secondly, the participatory learning has stimulated the innovative spirit of the farmers and enhanced the utilisation and dissemination of valuable indigenous technical knowledge. In addition, the approaches offer fast and facile means for reaching farmers relative to the traditional technology generation/ dissemination methods. Furthermore, some of the approaches' aspect of group-based activities offers a critical mass vital when demanding for services.

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