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MANUAL OF PARTICIPATORY R&D MODEL OF AGRICULTURAL EXTENSION




National Agricultural Policy Research Center (NAPREC)
Nepal Agricultural Research Council (NARC)

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AUTHORS

Sanjiv Subedi
Dr. Sudha Sapkota
Dr. Krishna Prasad Timsina
Deepa Devkota
Grishma Singh
Shiksha Khanal

National Agricultural Policy Research Center (NAPREC)
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BACKGROUND

Research and Development (R&D) model of agricultural extension in Nepal seeks to strengthen the agricultural extension system by enhancing the interaction among researchers, extension workers, and farmers, ensuring that agricultural technologies are effectively brought to the farmers. This manual presents a framework for the R&D model that fosters active cooperation between agricultural research institutions (such as the Nepal Agricultural Research Council, NARC) and local government extension services. By bridging research and extension, the model aims to make improved agricultural technologies readily accessible to farmers, directly contributing to increased productivity and resilience. This manual serves as a comprehensive guide for agricultural extension personnel, researchers, and farmers, outlining each step in the R&D process, from problem identification and research to field-level application and feedback collection. It provides practical methods for integrating farmers' insights into research, ensuring that the solutions developed are relevant, feasible, and impactful.

Through a participatory approach, the R&D model empowers farmers, researchers, and extension workers to interact and work together, leveraging local knowledge, scientific insights, and field experience for the better adoption of agricultural technologies. The R&D model acknowledges farmers not just as end users but as co-creators of technologies ensuring that agricultural practices meet the real needs of the farmers. The exchange of knowledge among researchers, extension workers and farmers are facilitated through result and method demonstrations which are critical tools in the participatory R&D model. These demonstrations provide farmers with hands-on exposure to new practices, showcasing both the process and the outcomes of adopting specific innovations. Result demonstrations show the outputs of recommended practices, while method demonstrations provide practical instructions. These demonstrations allow farmers to assess the benefits firsthand and build confidence in new technologies, promoting adoption and adaptation based on their observations.

Overall, this manual serves as a guide to implementing a participatory R&D model for the agriculture extension in Nepal. It outlines best practices for fostering collaboration among researchers, extension workers, and farmers, enhancing the capacity of extension personnel, and using demonstrations to make new technologies accessible and adoptive.

PREFACE

Farmers in Nepal currently lack sufficient access to extension services, leaving them unaware of recent advancements in agricultural research and innovation. Extension services are mainly provided by government agencies, Agrovets, and NGOs, but these efforts have proven limited in effectively transferring technology to farmers. This situation highlights the need for a more proactive mechanism that supports both the generation of new technologies and effective communication channels for technology transfer to farmers. As per Constitution of Nepal 2015, agricultural research is primarily the responsibility of federal and provincial governments, while extension falls under provincial and local government duties. However, local government units with major extension mandates face numerous challenges, such as limited skilled staff and gaps in technical and administrative expertise, which hinder the effective implementation of programs and projects. Furthermore, local governments often lack disciplinary specialists who can provide expert advisory services to farmers. To address these issues, it is essential to build the capacity of extension workers through practical training and by establishing forums where they can engage with agricultural scientists and specialists across different fields to address the production challenges faced by farmers.

R&D model is needed to facilitate the effective dissemination of improved technologies to the farmers. This manual aims to bridge the gap caused by a lack of skilled and trained personnel, technical expertise, and available technologies, as local units currently face significant challenges in these areas, impacting program and project implementation. The manual supports the implementation of the R&D model in agricultural extension, ultimately increasing farm productivity, farmer income, and knowledge on modern farming techniques and improved technologies. It emphasizes providing farmers with access to advanced agricultural technologies, participatory field monitoring among researchers, extension workers, and farmers, expert consultation via ICT and field visits, capacity-building training, consultative meetings with specialists, and access to relevant publications for extension workers and farmers. The method and result demonstrations of agricultural technologies included in this manual, such as high-yield varieties and plant protection kits encourages and motivates farmers towards innovative and improved farming practices. This R&D extension model focuses on a feedback loop, where research informs development and extension, and farmer feedback refines future research.

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1. Overview of agricultural extension

Agricultural extension refers to the practice of disseminating agricultural knowledge, information, and technologies among farmers to enhance agricultural productivity. This process involves the transfer of technologies, and best practices from researchers, and extension workers to the farming community. It involves the dissemination of knowledge, information, and skills to farmers, helping them adopt modern and efficient farming methods. The key components of agricultural extension include education, training, advisory services, and technology transfer.

Extension services aim to empower farmers by providing them with the necessary skills, information, and resources to make informed decisions about their farming practices. This can include guidance on modern and efficient farming methods, pest management, crop selection, and other aspects of agriculture. Agricultural extension also plays a role in helping farmers access markets for their products, providing information on market trends, pricing, and connecting them with buyers, facilitating community development, and promoting sustainable and environmentally friendly farming practices.

Overall, the goal is to improve the livelihoods of farmers, contribute to rural development, and ensure the long-term sustainability of agricultural systems. Agricultural extension services are typically provided by government agencies, non-governmental organizations (NGOs), research institutions, and other entities involved in rural development.

1.1. Stages of agricultural technology adoption

Stages	Action	Major Role
Awareness	• Farmers become aware of the new technology	Extension worker
Interest	• Farmers begin to show interest in the new technology • Farmers attend demonstrations, training, field schools etc. and evaluate the technology	Extension worker, Farmer
Evaluation	• Farmers assess applicability and viability of the technology	Researcher, Extension worker, Farmer

Stages	Action	Major Role
Trial	• Initial integration of the technology and testing it in the small scale • Farmers monitors results closely for e.g., cost savings, yield improvement etc.	Researcher
Adoption	• Farmers fully integrate the technology into their farming practices	Researcher, Extension worker, Farmer

1.2 Need of an innovative model of agricultural extension

Research and Development (R&D) approach to agriculture extension ensures a participatory approach for farmers. It encourages the active participation of key stakeholders (researchers, extension workers and farmers). Researchers bring scientific insights while extension workers act as intermediaries to facilitate the transfer of knowledge and skills from researchers to farmers.

At present, research, development and extension activities in the agricultural sector of Nepal are handled by independent organizations. However, there seems to be a lack of proper coordination and links between them. As a result, many farmers are unable to benefit from research outputs that could improve their agricultural productivity. Additionally, this does not allow researchers to create a bigger impact because they are not able to implement their research findings more widely. This can reduce the potential for agricultural advancements; therefore, to maximize the benefits of research for farmers, it is essential to integrate these sectors so that research can become more efficient.

Thus, an innovative approach that could build a platform bringing researchers, extension workers and farmers together through different interaction forums and activities that would contribute to increasing agricultural productivity and profitability is needed.

2. R & D participatory approach in agricultural extension

The synergistic effect of R&D could increase agricultural productivity and farm income by ensuring that agricultural innovations are effectively communicated and adopted by farmers through the collaborative efforts of different stakeholders. This model integrates research and development activities through a close linkage among researchers, extension agents, farmers and other relevant stakeholders. This model involves farmers and other stakeholders in the research and development process to improve the transfer of technology.

The participatory approach ensures the inclusion of all relevant stakeholders, researchers, extension workers and especially farmers, in the planning, design, and implementation of agricultural research and extension programs. Participatory extension involves capacity building at the individual and community levels. Farmers are trained to take on leadership roles, share their knowledge, and actively participate in problem solving. It encourages flexible and adaptive management practices. While incorporating modern agricultural technologies, the participatory approach ensures that the introduction and adoption of these technologies are done in consultation with farmers, considering their needs and preferences. The participatory approach aims at sustainable agricultural practices by considering environmental, social, and economic factors. It promotes long-term solutions that are environmentally friendly and economically viable.

Participatory approaches to agricultural extension employ different methods to facilitate the adoption of agricultural technologies among farmers. Farmers are directly connected to researchers where they share their local insights into identifying issues and developing new technologies. This inclusive approach ensures research is demand-based and relevant to the needs of farmers. Conducting trainings and field demonstrations is meant for capacity building and enhancing technical knowledge by displaying new farming technologies.

Field demonstrations include result and method demonstrations, which aim to provide farmers with first-hand information allowing them to observe the results and know about the methods. In the result demonstration “seeing is believing” emphasizes the outcomes and benefits. Farmers are shown specific agricultural technologies being implemented in the field where they can observe visible results like increased yields, and enhanced pest control. Results demonstration helps farmers understand the benefits of adopting a particular technology. Method demonstration emphasizes the “learning by doing” approach emphasizing the practical aspects of implementation. Method demonstration focuses on

illustrating the systematic process of a specific agricultural technology for e.g., planting methods, irrigation techniques, pest management etc. This approach provides practical knowledge to farmers.

Moreover, different Information and Communication Technology (ICT) tools, Mobile Apps, SMS alerts are used to disseminate information on weather forecasts, market prices, disease-pest outbreaks etc. Agricultural helplines can be established, for instance, the NARC toll free number: 1135; on Mondays from 4 pm to 6 pm, where farmers' queries are addressed and they receive guidance from the researchers on farming practices, pest control, and other agricultural issues they may be facing. Furthermore, collaboration with local governments and community-based organizations like agricultural cooperatives facilitates the dissemination of information and enhances the adoption of new practices. Participatory agricultural extension involves collaboration among the key stakeholders- researchers, extension workers and farmers where each of them plays a significant role in ensuring technology transfer, successful adoption and implementation. The overview of the roles of each of the stakeholders is hereunder:

i. Researchers

Researchers are responsible for developing and testing new agricultural innovations like crop varieties, disease and pest management etc. They also play a crucial role in conducting field trials and experiments to validate technologies. Further, they also publish and disseminate research findings through research papers, reports, and presentations that are the knowledge base for extension workers and farmers. Nepal Agricultural Research Council (NARC) is an autonomous organization that conducts agricultural research in the country. The major functions and responsibilities of NARC are to conduct qualitative agricultural research; provide research and consultancy services; coordinate, monitor and evaluate agriculture research activities in Nepal; and to document agricultural research activities.

ii. Agriculture extension workers

Agriculture extension workers facilitate technology transfer by acting as a bridge between researchers and farmers. They communicate research findings and innovation to farmers. They also organize training programs, visits and demonstrations to educate farmers about the benefits and implementation of new technologies. Extension workers provide advisory services to farmers addressing their specific needs and challenges. Further, they also collect feedback from

farmers about technologies and farm problems.

iii. Farmers

Farmers are the end users of agricultural technologies. They adopt agricultural technologies by participating in trainings, demonstrations, and field trials. They also provide feedback based on their experiences with the new technologies indicating areas for improvement. Farmers' feedback is very important to increase the adoption of technologies in the local context. They also contribute to spreading knowledge about successful practices within their community.

3. Methodology of R&D participatory approach of agricultural extension

The innovative agricultural technologies developed from research should reach to the farming community as soon as possible so that the number of early adopters and early majority would be more. The interaction among researchers, farmers and the extension workers virtually using ICT tools, face to face interaction through joint field visit monitoring, Focus Group Discussions (FGDs), capacity building trainings is quite necessary to strengthen the knowledge on improved farming practices among the farmers and extension workers. Also, the researcher will be aware of the real problems faced by the farmers relating to agricultural production and marketing. R&D approach of agricultural extension ensures the active participation of the researchers, farmers and the extension workers in the process of problem identification to technology verification, evaluation and dissemination.

The methodology of R&D participatory approach of agricultural extension is better shown in the flow chart in Figure 1 with two major components, process of technology dissemination and supportive mechanism. Moreover, the sub-components and process involved with these two major components of R&D model are also shown. The short description of the major components and sub-components of this innovative model of agricultural extension is mentioned in sequence.

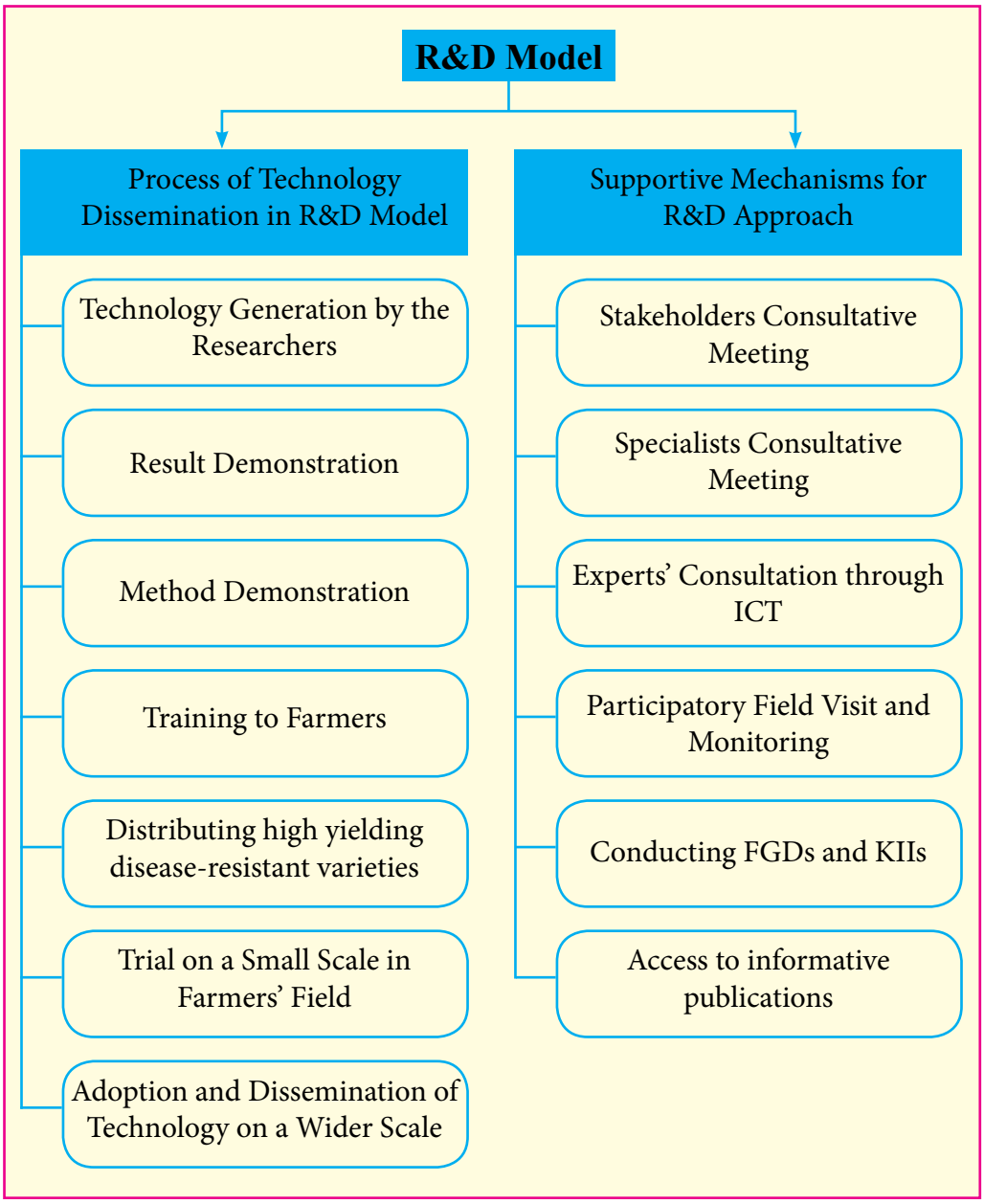

Figure 1. Framework of R&D participatory approach of agricultural extension

A. Process of technology dissemination in R&D model

i. Technology generation by researchers

Technology generation by researchers in the agricultural sector is a process that involves the development and innovation of new tools, practices, and techniques that are aimed at enhancing agricultural productivity, sustainability, efficiency, and cost effectiveness. This includes the development of advanced machinery, improved crop varieties, pest control methods, irrigation systems and environmentally friendly farming practices. Researchers focus on addressing the key challenges faced by farmers by conducting various experiments, field trials and studies. These technologies are developed to be transferred to farmers so that they can increase yields, improve the quality of their produce, reduce costs and help develop the overall agricultural sector.

ii. Result demonstration

This process involves showing new techniques, tools and methods to farmers in a way that is clear and directly applicable to their farming practices. Researchers explain the scientific principles behind those technologies and their benefits such as higher yields, cost savings, improved pest control, etc. Additionally, they share supporting data from experiments or trials that support the effectiveness of the technology based on scientific evidence. In many cases, farmers provide feedback to researchers after the demonstration so that the researchers can assist in the development of the technology so that it is adapted to local conditions and that will make it more effective in local environments and soils. This process ensures that the latest innovations in the agricultural sector are not confined to scientific laboratories but reach the grass-root level and benefit the farmers.

For example, results demonstration of two crop varieties: Local vs. Hybrid, where the yield of local variety is 6 tons/ha while that of hybrid variety is 10 tons/ha based on a trial conducted by researchers in several places.

iii. Method demonstration

Method demonstration is a detailed and systematic process to help farmers understand and adopt improved agricultural practices and technologies. Farmers are shown exactly how to perform each step by extension workers such that the steps are practical and easy to understand. In many cases, farmers are encouraged to try the methods themselves so that they can gain hands-on experience and reinforce their learning process as well as provide them with experiential learning opportunities.

A key benefit of this process is that it provides farmers with a level of confidence in their ability to apply new techniques, as they are far more likely to adopt them when they can see how they work first-hand and practice them on their own farms. In the long run, this process helps to build the capacity of farmers to implement advanced agricultural technologies, which helps enhance productivity and develop sustainability.

Figure 2. Method demonstration regarding the use of a Wota T trap to control *Tuta* insect in tomato

Figure 3: A farmer installing yellow sticky trap herself after method demonstration by the expert

iv. Training for Farmers and Extension Workers

Training is the process of learning a new skill or improving an existing one. It usually entails practicing specific abilities, receiving directions from an experienced person, and repeating tasks until you become proficient at them. For example, training for learning tactics, seeking guidance from trainers to improve performance, crop management workshops, agribusiness training programs, etc.

Training is provided to farmers and extension workers regarding use of improved agricultural technology which help to modernize agriculture and transfer knowledge from research institutions to farmers. This training aims to provide farmers with knowledge and skills that will assist them in adopting innovative approaches developed by researchers to make their farming more productive. Training is provided through workshops, seminars, on-farm demonstrations, farmers' field schools (FFS) and online courses and videos through ICT.

For example, farmers are taught how to manage pests through integrated pest management (IPM) approaches by employing cultural, biological, mechanical and chemical methods so that the use of harmful pesticides is minimized as much as possible. During the training, farmers learn how to accurately identify pests, understand their life cycles and decide which management techniques are most suitable for their specific farming conditions. This approach helps farmers in making informed decisions, minimizes their reliance on pesticides and promotes sustainable agricultural practices.

a. Exchange of knowledge, information, skills, and techniques

Training builds practical knowledge vital in key aspects such as soil health, insect control, crop management, and irrigation practices. This helps to enhance the ability of farmers, hence production and sustainability. The program provides farmers and extension agents with the latest in agricultural research, best industrial practices, and cutting-edge technologies that bridge the gap between basic science and real-world application on farms. Sharing innovative agricultural techniques, such as integrated pest management, precision farming, and organic farming practices, would vastly improve efficiency and productivity. This interaction can further help foster a culture of continuous improvement and adaptability in the face of change.

b. Access to innovative agricultural technologies

Advanced technologies can encourage sustainable behaviors in the sense that they may reduce the use of inputs like water, fertilizers, and pesticides; thus, environmental impact will be reduced, and natural resources conserved. Openness to new technologies facilitates agricultural monitoring, precision, and efficiency. That way, technology can enhance competitiveness through increased production, reduced costs, and better-quality produce. However, their collaboration can provide farmers with knowledge of market trends, outbreaks of diseases, and weather trends in

time to make the right decisions that help in reducing risks and optimizing resource use.

c. Capacity building of farmers and extension workers

Training in agricultural development represents an important capacity-building aspect for farmers and extension workers. Training may involve various topics, including access to market information, which should enable farmers to make better decisions and improve their income and livelihoods. Extension workers play a very important role in knowledge sharing and support for farmers. Building capacity among extension staff includes regular training on the latest agricultural innovations, communication strategies, and community engagement. They are trained on how to effectively transfer knowledge to farmers, solve problems, and facilitate access to resources and services.

d. A problem-based solution for the farmers

It includes pinpointing and attending to specific hindrances that farmers face through proper need assessments using surveys and interviews. This is a data-based approach, which ensures that interventions are directed toward specific needs that will provide individual training and resources to address their unique issues so that farmers can apply practical and effective solutions. This approach encourages the development and adoption of localized technology and practices to ensure that solutions are relevant to their specific environmental, economic, and social settings, therefore increasing their production and resilience. Modern agricultural technologies can therefore provide useful data that might be analyzed to arrive at better decisions and to come up with better crop management and better yield estimates.

e. Plan for improved farming practices, marketing, and financial budgeting

It develops a comprehensive plan for financial management, accessibility to the market, and improvement of productivity. In this aspect, it creates incentives for the practice of sustainable farming methods such as crop rotation, integrated pest management, and organic farming to enhance soil health and productivity. It further entails the help of farmers in creating direct market channels, embracing value-added processes, and understanding market trends to enhance market connections. Guidance on financial planning is also necessary in teaching farmers

how to efficiently manage their resources, obtain loans, and schedule their expenses to ensure profitability and long-term sustainability. The objective of this comprehensive approach is to furnish farmers with the resources and understanding necessary for financial success while maintaining ecological harmony.

The capacity building training insights into production technology, pest management, and marketing to boost vegetable production and productivity, consequently increasing net profits. The importance of ongoing interaction among researchers, extension workers, and farmers was highlighted, with emphasis on utilizing ICT tools like WhatsApp and continued field visit monitoring.

Figure 4. Photo taken after completion of the capacity building training given to the farmers and the extension workers

v. Distributing high yielding disease resistant varieties

The high yielding and disease resistant varieties of different agricultural crops, especially the varieties developed by NARC should be made available to farmers to motivate them for commercial agricultural production. There are several popular tomato varieties that have been developed such as Khumal hybrid 2 and Srijana, both of which are high-yielding varieties that should reach the fields of farmers. These two varieties of tomato were distributed to the leader farmers who had attended the training given by NAPREC and showed interest in the participatory approach of technology dissemination, expert consultation through field visit monitoring of the key stakeholders- researchers, farmers and the extension workers.

Figure 5: Seed distribution to the farmers by NAPREC team

vi. Trial on a Small Scale in Farmers' Field

During this stage, farmers test the newly developed technologies on a small-scale in their own farms so that they can observe and evaluate the practicality, effectiveness and adaptability of the innovations themselves. Researchers and

extension workers monitor the trial procedure as well as the results closely so that they know if the technology needs some changes regarding local conditions. At the end of the trial, if a promising outcome is achieved, it is recommended that the technology be spread across a broader range of farms on a large scale and for a larger number of farms to benefit from it.

For example, testing of newly introduced drought-resistant crop varieties on a small segment of the farmers' fields. This kind of testing helps farmers to observe how these new varieties perform under local conditions. Since those varieties are tested under real-time farm conditions, farmers are more probable to adopt them if they are proven more effective compared to the traditional varieties.

Figure 6. Use of tomato grafting technology as a trial by a farmer in Belkotgadhi, Nuwakot

vii. Adoption and Dissemination of Technology on a Wider Scale

When small-scale trials are proven successful, extension staffs encourage this technology to be adopted on a larger scale. This process is done so that it helps a larger number of farmers get the benefits of the innovation, which can contribute to improving the productivity and sustainability of traditional agricultural practices. To effectively disseminate technology on a wider scale, various steps are employed such as demonstration of the technology, farmers training through farmers' field school (FFS), information circulation through digital platforms, awareness campaigns and farmers-to-farmers learning and dissemination.

Figure 7. Adoption of technology on a larger scale

B. Supportive Mechanisms

i. Stakeholders Consultative Meeting

A stakeholder consultative meeting is a platform where various parties related to agriculture come together to discuss, collaborate and provide their inputs regarding agricultural developments. The stakeholders include researchers, scientists, government and policymakers, private sectors, agribusinesses, extension workers, and farmers and producer groups. During these meetings, the areas that require immediate focus, strategies to improve the adoption of new agricultural technologies by farmers, need for training programs and skill development, and funding and resource allocation are discussed. These meetings ensure that research and technological advancements in agriculture are accessible, practical and sustainable.

Figure 8: Photo taken during the stakeholders' consultative meeting

ii. Specialist Consultative Meeting

Specialist consultative meetings involve a focused gathering of experts in various agricultural fields including agricultural scientists, researchers, extension workers, agribusiness and technology experts and policymakers. These specialists bring advanced knowledge, new ideas, technologies and methodologies to enhance agricultural productivity and solve complex problems in the field of agriculture. Detailed proposals to suggest new research areas as well as policy recommendations are made because of these meetings. These specialists depend upon data and research findings while suggesting solutions that can be applied practically in farmers' fields.

Figure 9. Photo taken during the specialist consultative meeting

iii. Expert consultation through ICT

The current agriculture extension system has become more and more reliant on information and communication technology, completely changing the ways of interaction, information, and business management by farmers. ICT in agriculture ranges from general web platforms and mobile applications to drones and remote sensing. Such tools make critical agricultural facts, market data, weather forecasts, and best practices easily accessible to farmers, which can assist them in their decisions and maximizing yields. One of the major advantages of ICT in agriculture is its ability to overcome geographical barriers. It has been used as a prime source for expert consultation in different parts of Nepal. ICT provides access to relevant information and professional guidance through computers or mobile phones, hence bridging the great gaps in many rural locations where farmers lack access to traditional extension services.

Farmers are using ICT technologies such as WhatsApp to seek discussions and guidance on agricultural issues. A panel of experts, extension workers, and farmers was formed to address challenges from several disciplines, including soil science, horticulture (Olericulture), plant pathology, and socioeconomics. This procedure resulted in an immediate response from experts as well as interaction among Agri-extension system stakeholders such as farmers, researchers, and extension workers. This allows them to make the correct judgment at an appropriate time.

Experts' consultation is conducted through Information and Communication Technologies (ICT) to connect farmers with agricultural experts, which helps to provide them with real-time consultation and advice on different agricultural issues that come across on their farms. Digital tools such as mobile applications (WhatsApp, Viber, Facebook groups, etc.), internet platforms, video conferencing (Zoom, Google Meet, etc.), mobile SMS and agriculture-specific apps are used to help farmers solve their farm-based challenges. Farmers can take pictures and/or videos of their crops/livestock and get feedback and solutions from experts regarding agricultural issues such as plant diseases, insect pests on crops, nutrient deficiencies, livestock health, etc. in real-time using ICT methods. This method helps in improving access to expert advice, decreases response time and helps farmers in managing agricultural problems more effectively.

ICT enables real-time communication and collaboration between farmers, extension workers, researchers, and policymakers. Online forums, social media, and messaging apps have proven to be valuable outlets for knowledge sharing, networking, and mutual assistance among farmers. Farmers can share ideas, seek advice from each other or experts, and even participate in virtual training or webinars to improve their skills and expertise. This interconnectedness fosters a sense of community and collective learning, allowing farmers to handle common difficulties and execute new growth and development opportunities together.

RATES/AFACI project implemented by National Agricultural Policy Research Centre (NAPREC), NARC is providing agricultural advisory services to the farmers of the project intervention sites facilitating disciplinary expert consultation through ICT (WhatsApp).

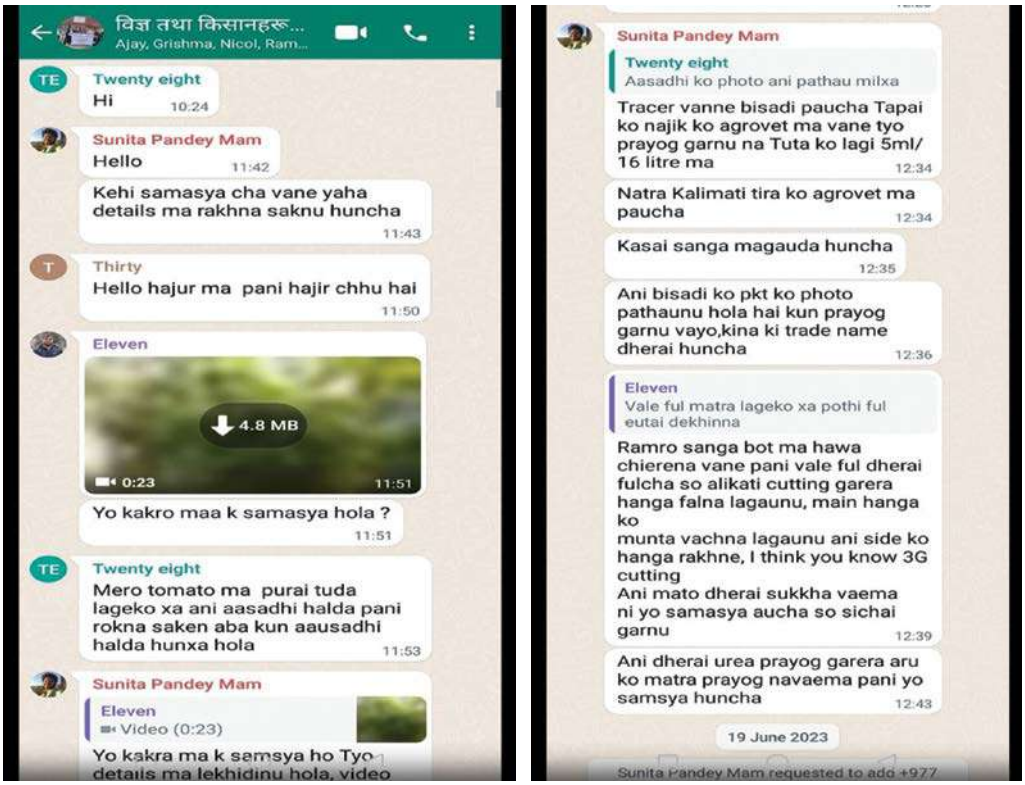

Figure 10. Farmers getting their queries solved through experts' consultation on WhatsApp (an ICT approach)

iv. Participatory Field Visit and Monitoring

Participatory field visits and monitoring are conducted jointly by farmers, researchers and extension workers to observe and monitor the progress of innovations, practices or technologies that are employed in the farmers' fields to identify potential challenges and successes as they appear. During these field visits, they collect data such as crop yields, growth patterns, pest infestations, input efficiency and overall crop performance. The main purpose of this step is to identify any challenges farmers face while adopting new technologies and resolve any unforeseen circumstances that may arise during that process. Researchers and extension workers might as well provide immediate technical advice or required adjustments so that the technology works better on farmers' fields. These groups of people exchange information and share knowledge, feedback and experience to improve the outcomes of agricultural research and development (R&D).

Figure 11. Participatory field visit monitoring by farmers, extension workers & NARC scientists

v. Conducting Focus Group Discussions (FGDs)

FGDs are small groups of diverse participants who come together to discuss specific topics. Facilitators of these groups ensure that the discussion maintains a semi-structured format to encourage free discourse while keeping it focused. Focus Group Discussions is systematic and interactive method of obtaining qualitative data through dynamic and in-depth discussions. This is mostly structured, allowing for a deeper exploration of specific issues. FDGs are important to farmers for the following reasons:

a) Provide Shared Learning: Farmers can share knowledge and experiences, learning from each other's successes and challenges.

b) Identify Common Issues: FGDs help in identifying and understanding common problems and needs in the farming community.

c) Influence Policy and Practice: Insights from FGDs can inform agricultural policies, extension services, and development programs to better support farmers.

d) Promote Community Engagement: FGDs promote active participation and cooperation among farmers, fostering a sense of community and collective action.

The FGD conducted among the key stakeholders- farmers, extension workers and the researchers were mainly focused to assess the perception of farmers on use of NARC released varieties, access to improved agricultural technologies, knowledge level upgraded on pest management after having expert consultation through ICT (WhatsApp) and motivations gained from participatory field visit and monitoring.

Figure 12. Photo taken after FGD

vi. Access to informative publications

Printed materials such as booklets, manuals, and articles should be published and made available to farmers and extension workers. The valuable information on improved farming methods and technologies in these published materials highly contributes to enhancing the technical knowledge of farmers and extension workers.

Figure 13. NAPREC/NARC scientists providing booklet to farmers

Figure 14. Booklets published relating to commercial tomato and vegetable farming techniques

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Reforming Agricultural Extension System in Nepal: What can we adopt from selected Agriculture Led Countries?

Krishna Prasad Timsina[1@], Sanjiv Subedi[1], Sunita Pandey[2], Deepa Devkota[1], Aabhash Aryal and Jeevan Lamichhane[3]

[1]National Agricultural Policy Research Centre (NAPREC), Nepal Agricultural Research Council (NARC), Khumaltar, Lalitpur, Nepal; [@]krishnatimsina2000@gmail.com; https://orcid.org/0000-0003-4005-7039,
SS: sanjiv.subedi@gmail.com, DD: deepadevkota01@gmail.com, AA: artistaabhash@gmail.com
[2]Prime Minister Agriculture Modernization Project (PMAMP), Khumaltar, Lalitpur, Nepal;
SP: pandey.sunita2009@gmail.com
[3]National Agricultural Technology Information Centre (NATIC), Nepal Agricultural Research Council (NARC), Nepal; JL: jeevanlamichhane7@gmail.com

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Figure 15. Snapshot of the published journal article on reforming agricultural extension system in Nepal

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Policy brief 2024

Empirical research on the participatory approach of agricultural extension: R & D Model

Krishna P. Timsina, Sudha Sapkota, Sanjiv Subedi, Deepa Devkota
National Agricultural Policy Research Centre, Nepal Agricultural Research Council

Figure 16. Snapshot of the published policy brief concluding the need of R& D participatory approach of agricultural extension in Nepal

4. Case Studies: Effectiveness of researcher-extension worker-farmer inter-linkage through ICT in solving farmers' problems

4.1 Case study – I:

Mr. Khem Raj Pandey aged 48 (Mobile No.: 9851098248) of Belkotgadhi-13, Nuwakot has been engaged in commercial vegetable cultivation for the last two decades. He was one of the participants in the orientation training on tomato farming technology, insect pest management and value chain from the RATES project supported by RDA/AFACI.

As far as the use of ICT is concerned, Mr. Pandey is an active member of the WhatsApp group comprising local level extension staffs, farmers and scientists/experts. Within this group, he frequently communicates regarding the disease-pest problem with local level extension staffs and experts regarding the problems that arise in his farming practices. He sends pictures of different infected plants and gets back suggestions for appropriate management from the concerned scientist/specialist/expert. For instance, he had cultivated soybeans on six ropani of land that started showing symptoms of yellow patches on the leaves causing them to dry and wrinkle. He sent the photo on WhatsApp and quickly received effective management techniques, and the problem was resolved within 72 hours of applying the recommended management practices. He expressed high satisfaction with this interconnected linkage between farmers and scientists/experts in coordination with the municipal agricultural section through ICT. Finally, he got the best price for the soybeans produced on his farm having total sales of nearly NPR 0.17 million.

Currently, his annual income from vegetable production is NPR 2 million. Last season, he cultivated tomatoes on 0.66 ha of land. The tomato crop was planted in March 2023 and started harvesting from May until June 2023. Mr. Pandey possesses a very good knowledge of tomato production and disease-pest management with the judicial use of pesticides. After getting training from RATES and joining the interlinked forum, his confidence in using ICT has been enhanced; he has been consulting with experts regarding issues faced in vegetable farming and insect-pest management through ICT very conveniently. He was able to control *Tuta* largely in his tomato farm by acquiring the appropriate pesticides. Despite having a good production of tomatoes, Mr. Pandey faced challenges in obtaining favorable market prices for his tomatoes and looked for different alternatives markets. This year his total tomato production was 1600 crates (one crate = 23 kg). Out of this total production, 100 crates were used

for home consumption and distributed to neighbors while the remaining 1500 crates were sold to the market. The selling prices ranged from NPR 500 to 700 per crate. He sold the tomatoes worth NPR 0.35 million to Rasuwa district after deducting the transportation costs of NPR 100 per crate. He selected the variety considering harvesting time, thickness of fruit (to reduce post-harvest loss) and other attributes that helped in easy marketing of the tomatoes. Mr. Pandey felt that training and regular interaction with experts facilitated by RATES/ NARC/AFACI, and local government had important contributions to enhance his technical knowledge regarding varietal selection, farming practices and access to market information. He is excited to use new varieties and production technologies after consulting with experts through local government in the days to come.

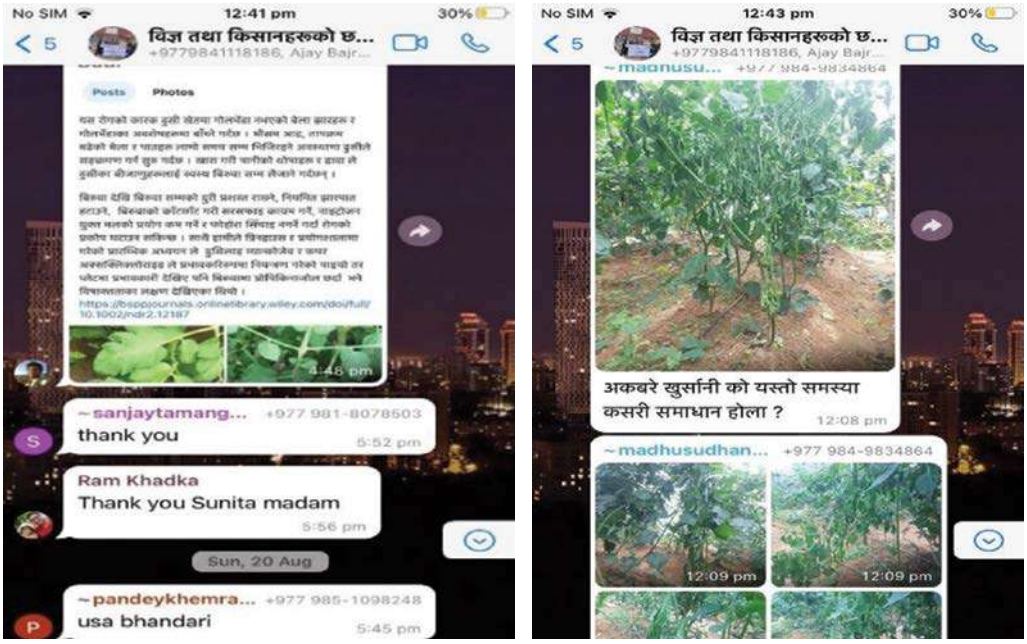

Figure 17. Snapshots of the interaction of farmers with the experts through WhatsApp (ICT)

4.2 Case study – II:

Laxmi Karki, age 36, is a female commercial vegetable farmer from Panauti-4, Khatri Gaun, Nepal. With a bachelor's degree, she was a primary level teacher in a boarding school and transitioned from teaching to commercial vegetable farming six years ago. Her husband, an army officer living away from home, supported her decision. She took up farming due to limited opportunities in her

teaching career. She is engaged in commercial vegetable farming on leased 0.25 ha (5-ropani) land, costing NPR. 50,000 annually. She is the second person in her village to adopt tunnel farming. At present, she has 35 tunnels each of 12 m*5 m size. In her first year, she successfully grew and sold tomatoes for NPR. 90 to NPR. 100 per kg, followed by cauliflower cultivation. Despite the COVID -19 lockdown, she managed to sell her produce locally and in the capital city of Kathmandu, located about 35 km from her village. Although she encountered challenges acquiring supplies like wires and ropes for tomato staking during the pandemic, her production and marketing were not much affected.

Ms. Karki maintained regular contact with agriculture extension officers from the municipality to receive advisory services for vegetable production. However, she always felt lacking the disciplinary expert consultation service at the municipal level and had faced problems relating to pest management and had little access to new agricultural technologies. Two years ago, she met the researcher team from the National Agricultural Policy Research Centre (NAPREC) of the Nepal Agricultural Research Council (NARC) during a training session titled "Tomato Farming Technology, Insect Pest Management, and Value Chain" at the Panauti Municipality office, organized by NAPREC under the RATES/AFACI project. She found the training very informative, learning about tomato cultivation practices from nursery establishment to harvesting. She learned to use coco peat and trays for nursery establishment. However, due to the high costs incurred in coco peat, she had grown seedlings in nursery beds as well. Now, she grows half of her seedlings in trays with coco peat and the other half in nursery beds. In the training, she additionally gained valuable knowledge about disease and pest management for tomatoes and the importance of record keeping. She started keeping records of pesticide costs and labor usage. For tomato cultivation, she employs 10-15 laborers per season.

She is extremely pleased with the researcher-extension-farmer interaction envisioned by the RATES/AFACI project to evaluate the effectiveness of the Research and Development (R & D) model. She believes this interaction has been invaluable in addressing her problems related to vegetable production. She feels fortunate to have been selected by the municipality to receive the training provided by NAPREC and to be in the WhatsApp group. Regular monitoring of her field by experts keeps her motivated. She is an active member of the WhatsApp group for expert advisory services where she and other vegetable farmers can directly consult with experts and receive immediate solutions to their problems.

From NAPREC, she received seeds of Srijana and Khumal Hybrid (K2) varieties of tomato. She is continuously receiving expert advisory services from entomologists and pathologists from NARC via WhatsApp as well as field visits. She is pleased with the frequent field visits and monitoring by extension officers from the municipality and scientists from NARC. She recounted an incident when her tomato crop started wilting and she sought help from the municipal office. The deputy mayor and extension officers conducted a field visit, identified the problem as Fusarium wilt, and confirmed it by sending samples to NARC. They recommended using Bavistin (0.1%), which saved her crop. Later, entomologist Mr. Sudeep Upadhayay (Scientist) from NARC visited her farm when her transplanted tomato crop was just a month old. To control Tuta, she had sprayed Karma's Magic (Diflubenzuron 20%EC) @ 0.5-1ml/liter of water twice at an interval of 10 days. However, the entomologist recommended alternating pesticides, such as using Emamectin benzoate @ 0.33g/liter of water after the initial Karma's Magic application, for better effectiveness. He also advised that Neem-based pesticides are effective at the initial stage of Tuta. The NAPREC team provided Ms. Karki with four Wota T pheromone traps, four Tuta lures and eight yellow sticky traps. The entomologist demonstrated how to install pheromone traps. Additionally, he suggested using Roger @ 1.5ml/litre of water or Thiamethoxam 25% WG @ 0.5 gram per liter of water to control whiteflies.

Ms. Karki earns a substantial income from vegetable cultivation, allowing her to cover daily household expenses and pay for her daughter's school fees in a boarding school where she is in class six. Her gross profit from vegetable farming is around 6-7 lakhs per year, with a net profit of about 3-4 lakhs per year after deducting production and lease costs. Additionally, she has provided regular employment for two people. Ms. Karki's success as a commercial vegetable farmer demonstrates the viability and profitability of commercial agriculture. Her ability to generate a substantial income not only supports her household expenses and her daughter's education but also contributes to the local economy by providing employment opportunities. Her gross and net profits from vegetable farming highlight the economic potential of adopting modern farming techniques and leveraging agricultural training and support services via researcher-extension-farmer interaction.

Figure 18. Glimpse of the participatory field visit, harvested tomato & farmer-expert interaction