ROLE OF SCIENCE COMMUNICATION IN TRANSFER OF TECHNOLOGY (TOT) FROM LAB TO LAND

With special reference to Onion cultivators in Nasik district of Maharashtra

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Abstract: The objective of this research paper is to examine the role of effective science communication strategies in the transfer of technology (TOT) from Lab to Land. Science communication strategies used for twelve different Extension Methodologies (EMs) viz. Demonstration; Podcasts; Field Days; Farmers' Meetings; Trainings; TV Programs; Radio Talks; Seminars; Exhibitions; Leaflets, Pamphlets, Technical Bulletins and *CDs*; Farmers Group Visits; Kisan Mela; used by the agricultural extentionists were taken into consideration to examine and study the attitude and behaviour of the farmers towards these. Survey and Interview methods of research, the paper explores the following research questions-
1. Which Extension Methodology (EM) is considered best by the farmers?
2. Which programs pertaining to EM do the farmers attend most often?
3. What according to farmers are the gaps pertaining to communication strategies vis-a-vis TOT?
4. Why and how appropriate communication methodologies, channels and tools should be used at appropriate time to provide **maximum benefit** to farmers?
5. What is the role and impact of science communication in TOT from Lab to Land?

Key Words

Communication Strategies, Lab to land, TOT, Podcasts, Sustainable, inclusiveness

I Methodology

This research Paper is based on quantitative and qualitative analysis. Tools and techniques used for data collection and answer the research questions are Survey (Schedule), Structured Interview. Sample size is 75 farmers and 4 Scientists (convenient Sampling). Schedule was filled by randomly selecting 75 small and marginal onion cultivators. 15 each from five tehsils Deola, Niphad, Chandwad, Nandgaon and Satana at Nasik district of Maharashtra in India. Four scientists of National Horticulture Research and Development Foundation (NHRDF), tehsil Niphad, Nasik were interviewed.

II Introduction

Developing countries today face a wide range of needs, from more secure food supplies to cheap and effective medicines. One factor that almost all these needs have in common is that satisfying them adequately will not occur without the use of modern science. Development can be characterised as the process of putting scientific and technical knowledge into practice. Conversely, it is important that building the capacity to absorb and make use of scientific and technical knowledge must be placed at the heart of the development aid efforts if these are to be successful in achieving their goals.

But knowledge will not reach those who can benefit from it unless it has been effectively communicated to individuals with the power and skills to put it into practice, whether those are government officials and decision-makers, community groups and their representatives, or even non-governmental organisations. Formal education, of course, has a key function here but so does the informal education provided through science communication. Furthermore, information and communications technologies (ICTs) have an important role to play in this process by reducing or eliminating the transactional (nonproduction) costs of communicating knowledge about science and technology.

There is an ardent need for integration among people and institutions, particularly in the research-extension-farmer relationship. Extension services are often under-equipped in terms of staff, transport and accommodation as well as inadequately trained for effective communication. Especially in areas where small scale agriculture is predominant and a wide array of crops is grown, there is a need for extensionists with a broad level of technical skills and expertise.

In addition, recent experiences show that depending on the situation, the human components of the system go beyond the researchers, educators, extensionists and farmers. In the traditional research context, agricultural scientists tend to overlook situations at the farm level. Their research projects are often oriented at producing publications rather than solving concrete on-farm problems. Producers on the other hand expect immediate answers to local problems, and are not concerned with experimental details or the goals and objectives of the scientists.

Many linkage problems between major institutional actors are caused by a lack of coordinated planning, poor communication between linkage partners, and absence of follow through with actual linkage resource planning or implementation. In addition, there is typically little or no involvement at all of representative farmers or their organizations. A lack of appropriate

communication structures, methodologies and tools results in poor identification of farmers' needs and priorities, inappropriate research programs, poor or irrelevant extension information and technologies and finally, low farmers' take-up of technology innovations. The poor results have led to dwindling factor allocation to agricultural research and extension. These are by no way new problems, but **they need to be addressed again in the light of new developments in media and communication technologies and new support strategies to rural areas (programme based approaches**). The recent drive towards donor harmonization and alignment offers a chance to overcome these challenges in a more comprehensive and coordinated manner.

Rural communication and further science communication in rural areas is an interactive process in which information, knowledge and skills, relevant for development are exchanged between farmers, extension/advisory services, information providers and research either personally or through media such as radio, print and more recently the new "Information and Communication Technologies" (ICTs). In this process all actors may be innovators, intermediaries and receivers of information and knowledge. The aim is to put rural people in a position to have the **necessary information for informed decision-making and the relevant skills to improve their livelihoods**. Communication in this context is therefore a non-linear process with the content of data or information.

At the same time, it is important that the practice of science communication takes place in social context. In other words, it is not just a question of conveying information, but also of engaging the potential users of that information. The need is to encourage dialogue and eventually to empower those to whom the information is being provided so that this information can be applied in a practical and useful way.

III Need for the Study

Agriculture is an important part of Indian economy. It is considered that with the right technology and policies, India could contribute to feeding not just itself but the world. However, agricultural output of India lags far behind its potential. The low productivity in India is a result of several factors. One of the factors is adoption of modern agricultural practices and use of technology is inadequate, hampered by ignorance of such practices, high costs, illiteracy, slow progress in implementing land reforms, inadequate or inefficient finance and marketing services for farm produce and impracticality in the case of small land holdings. Science communication plays an effective role in persuading stakeholders in agriculture to use technology which is developed in laboratories. It could only be done if information is transferred to the targeted stakeholders at appropriate time in an easily understandable manner. Hence there is a need to examine the role and impact of science communication in TOT from lab to land. There is also a need to find out best possible communication strategies and model for communicating science to their stakeholders and in this case are the farmers, general masses, journalists and industry (Agro based manufacturers, traders). What extension methodologies are being adopted by scientists? Is there any gap which is hindering the effectiveness of communication process and hence TOT is not taking place in the manner it should? If the gap exists then there is a need to fill this gap. What efforts are being done to this end?

IV Science Communication

Communication is a process that allows people to exchange information by several methods. It requires feedback. Communication can be defined as the process of meaningful interaction among human beings. It is the art of passing information and the process by which meanings are exchanged so as to produce understanding. It is the process by which any message is given or received through talking, writing and making gestures.

Sender, message, channel and receiver are the essentials of communication. Sender sends a message with a purpose to the receiver through some channel. The receiver decodifies the message and sends feedback to the sender. The sender is now the receiver and decodifies the message received and again sends message. Thus we see that communication is a cyclic process and continues till the purpose is fulfilled. On the basis of sender and receiver, communication can be classified as intra personal, inter personal, group and mass communication.

Communication represents enormous variety of purposes e.g. attempting to influence individuals' voting behavior (Political Communications), consumers' purchase decisions (Marketing Communications), discourage/promote certain social behaviour (Social Communications), promote use of contraceptives and other methods (Family Planning Communications), promotion of birth control measures (Population Communications), promotion of better health care and support services (Health Communications).

Similarly **Science Communication** is a process to promote scientific behaviour and use of technologies developed in labs. It is a communication between science communicators and society. It is crucially important as it informs the broader public about issues related to science and technology. It informs science about societal perceptions and expectations, it makes scientific expertise publicly available, it has an impact on policy-making and agenda setting, it affects the legitimacy of research, and it plays a major role in the governance of science, technology and risk. But communication is also vulnerable to misunderstandings and misuses: over-simplified models and concepts about how science and society communicate, unrealistic expectations on both sides regarding the benefits of communication, and forms of communication that increase the distance between science and its extra scientific audiences rather than 'engaging' them. Science communication may be able to help to establish a transparent and open form of communication in both directions that contributes to defining the role of science in society, and to enabling society to make the best use of scientific knowledge.

V Transfer of Technology (TOT):

Technology transfer or transfer of technology (TOT) is the process by which technology or knowledge developed in one place (eg. Lab) or for one purpose is applied and exploited in another place (eg. Land or Industry) for the same or some other purpose.

Technology transfer is the process by which existing knowledge, facilities, or capabilities developed under federal research and development (R&D) funding are utilized to fulfill public and private needs.

VII Basis of Qualitative Analysis:
Analysis of science communication strategies for TOT at three levels-
7.1 Extension
7.2 Communication methodologies and channels
7.3 Stake Holders (Farmers).
Which are further classified to-
7.4 Audience segmentation- This involves identification of target audience and then dividing the same into smaller groups for easy access and handing. For example adolescents, youth, middle aged, male and female etc. The basic idea behind audience segmentation is to direct the flow of communications towards a specific group and increase the concentration of efforts in a particular direction to get high efficiency/success rate.
7.5 Differential communication strategy- This involves division of the target audience further into groups having specific characteristics (nodal points). These 'nodal points' serve as 'entry points' to penetrate the group and influence their behaviour and attitudes. Since each group would be different from the other, it will require a different communication strategy. Differential communication strategy involves direction of communication efforts suited to the 'needs' of each group in order to bring about desired changes.
7.6 Level of communication intervention- mass level, group level and individual level was done in light of 12 extension methodologies used by National Horticulture Research and Development Foundation (NHRDF), tehsil Niphad, Nasik, Maharashtra.

VIII Findings

8.1 Extension-
8.1.1 Extension Methodologies
No recognised or applied quality standards for:
8.1.1.1 Necessary capacities of advisory services/ information providers
8.1.1.2 Messages may or may not be transferred through media and advisory services

8.1.2 The content of extension messages
The content of extension messages and market information is decided:
8.1.2.1 Centrally
8.1.2.2 Only on technical basis
8.1.2.3 Rural communities are not actively involved in the identification of communication contents, such as problems, search for solutions as a routine procedure

8.1.3 Propagation of Extension Messages
8.1.3.1 Extension messages are isolated technical information and extension campaigns, without testing and follow-up
8.1.3.2 Strategic mix of media is not done in campaigns in order to impact on a maximum number of farmers. However, it is claimed that Demonstration, Kisan Melas, Field Days, Farmers' Meeting, Exhibitions, Trainings, TV Programmes, Radio Talks, Seminars, Leaflets, Pamphlets, Technical Bulletins and CDs, Farmers Group Visits are being used to propagate extension messages.

8.2 Communication Methodologies and Channels-
8.2.1 No capacity development of communication service (extension, advisory, information) providers in:
8.2.1.1 Participatory methods
8.2.1.2 Media use
8.2.1.3 Communication methods
8.2.1.4 Adult education principles

8.2.2 Communication channels:
8.2.2.1 The practice of communication between research, advisory/information services and farmers is top-down and one-way (flow of information and knowledge) communication.
8.2.2.2 Demand-oriented communication service provider are not being used for creating a positive learning environment.
8.2.2.3 There are no efficient mechanisms in place that allow feed-back and formulation of service demands by clientele i.e. top-down and down-top, two way communication.

8.2.3 Communication providers:
8.2.3.1 Have a hierarchical communication culture
8.2.3.2 Do not allow participation in decision making

8.2.4 The media strategies in rural areas are:

8.2.4.1 Not differentiated to various target groups
8.2.4.2 Are context specific
8.2.4.3 They do concentrate on various medium
8.2.4.4 Not designed and implemented by media specialists
8.2.4.5 There is a need for coherent, strategic use of suitable media mixes (pictures, film, voice, podcasts, internet, etc.) in campaigns, designed and partly implemented by media specialists.
8.2.4.6 The target audiences are not analysed and the content of the communication is not adjusted to their needs.

8.2.5 No specific bureaucratic and administrative Monitoring and Evaluation (M&E) mechanisms in interventions and media campaigns for:
8.2.5.1 Checking activities
8.2.5.2 Collecting data for consequences for management
8.2.5.3 Controlling personnel
8.2.5.4 M&E is for internal information only

8.2.6 There is a need for comprehensive M&E system (baseline, activity, impact):
8.2.6.1 For steering and managing interventions, thus improving transparency and communication
8.2.6.2 For raising consciousness among farmers

8.3 Stakeholders:
8.3.1 Clientele in rural areas is:
8.3.1.1 Not or hardly organized
8.3.1.2 Mostly subsistence farmers
8.3.1.3 Scattered over a large area
8.3.1.4 Has none or few, representative farmer organizations
8.3.1.5 Farmer organizations do not have clear mandate and capacities for playing an active role in transfer of technology

8.4 Farmers, as clientele for communication providers, have:
8.4.1 Unclear or unrealistic demands for communication services
8.4.2 No legitimate or representative voice for demanding communication services
8.4.3 Very few farmers are able to articulate well defined, representative and legitimate demands to communication service providers that can be fulfilled with the available means.

8.5 In the above mentioned (1-3) analysis pointers scientists did not use communication strategies pertaining to audience segmentation or Differential communication strategy. However, level communication strategies were used.

IX Findings of Quantative Analysis

9.1 New Technologies Pertaining to Onion cultivation transferred by National Horticulture Research and Development Foundation (NHRDF) in the last two years (2015-16 & 2016-17).
9.1.1 Seed Production (High Yielding Varieties of Onion and Garlic)
9.1.2 Kharif Onion Production Technology
9.1.3 Micro Irrigation for Onion and garlic
9.1.4 Weed Management in onion
9.1.5 Integrated Nutrient Management for sustainable Rabi Onion
9.1.6 Integrated Pest and Disease Management
9.1.7 Storage Environment/ Structures
9.1.8 Post-harvest management of Onion

9.2 The following EMs are being used by the Scientists:
9.2.1 Demonstration
9.2.2 Field Days
9.2.3 Farmers' Meeting
9.2.4 Exhibitions
9.2.5 Trainings
9.2.6 TV Programmes
9.2.7 Radio Talks
9.2.8 Seminars
9.2.9 Leaflets, Pamphlets, Technical Bulletins and CDs
9.2.10 Farmers Group Visits
9.2.11 Kisan Mela
9.2.12 News published in the newspapers

9.3 Scientists consider the training and farmers consider demonstration to be the best vehicle for the effective TOT.

9.4 Effective Science communication strategies play an important role in increasing awareness of farmers and thereby result in their behaviour change.
9.5 63% respondents have awareness regarding below mentioned technologies:
9.5.1 Nursery Management
9.5.2 Increase in the yield
9.5.3 Nutrient Management Under different soil conditions
9.5.4 Weed Management
9.5.5 Irrigation Management
9.5.6 Plant disease Management
9.5.7 Insects and pesticides Management
9.5.8 Post-harvest management (Process of handling, storage, and transportation)
9.5.9 Precautions to be taken during natural calamities hail storm, heavy rains, storm, flood etc.
9.5.10 Reduction in Input cost/ Expenditure

9.6 78% respondents accept that their knowledge/awareness related to new technologies pertaining to agriculture increased through EMs like Demonstration, Krishi Mela, Exhibitions and Field Visits, facilitated by Scientists. Programs related to these EMs are attended most often by the farmers.

9.7 62% farmers think that gaps related to designing of science communication strategies in EMs which act as a barrier in understanding and increasing the awareness of a particular technology are-
9.7.1 Difference in the education level of the sender and the receiver
9.7.2 Grasping power of the receiver
9.7.3 Learning desire of the receiver
9.7.4 No feedback taken from the receiver

9.8 75% farmers are of the opinion that constraints in understanding the content pertaining to transfer of technology (TOT) during the training sessions are-
9.8.1 Less education of farmers
9.8.2 Less experience in the field
9.8.3 Apprehensions related to Technology creates the mental Block
9.8.4 No feedback is taken from the farmers
9.8.5 Content delivered is sometimes not practically feasible on the field

9.9 95% farmers agree that in order to make agriculture viable, profitable and sustainable farmers should be timely made aware about the following through robust communication channels-
9.9.1 How to make agriculture more profitable so that existing farmers lead a better quality of life and more young people get attracted to this profession.
9.9.2 Existing pro- farmer policies.
9.9.3 Four Is - Irrigation, Infrastructure, Investment and Insurance sectors
9.9.4 Judicious use of scarce resources like water, electricity
9.9.5 Thoughtful/ less use of fertilizers and pesticides
9.9.6 Latest know-how, trainings and demonstrations on the field in, do-how to improve farm productivity

9.11 98% farmers accept that they need training and information on:
9.11.1 Risk mitigating skills
9.11.2 Information on diversification alternatives
9.11.3 How they can sell their surplus production.
9.11.4 Current market rates to sell their produce at competitive prices

9.12 56% respondents accept that awareness and knowledge regarding new technologies and their use in field helped in increase in their Income. Most of them purchased property, tractors, modern machines, jewellery and made FDs for their children.

9.13 58% accept that there social status has improved.

X Conclusion

10.1 Science communication plays a vital role in TOT from Lab to Land. If a technology is transferred successfully it brings positive impact and remarkable improvement in the life of farmers and farm sector. If farmers understand a particular technology in a better manner they adopt it without any apprehension. This results in increase in the yield of crops and thereby increasing their income. The research reflects that more than 55% of the farmers accept that their income and social status got improved when they adopted new technology.

10.2 The risks for subsistence/small farmers are acute since their livelihoods depend on self-sufficient production. Therefore they need risk mitigating skills and information on diversification alternatives and, assurances in the form of information that shows how they can sell their surplus production, as well as ensuring sufficient production under unpredictable external situations.

10.3 Science communication strategies pertaining to audience segmentation, differential and level communication should be used by the agricultural extentionists in TOT judiciously as per the needs and scenario so that maximum farmers are benefited.

10.4 Special training sessions and demonstration of technology in farmers' field to be done by agricultural extentionists.

10.5 Farmers should be timely made aware about the following through robust communication channels-
10.5.1 How to make agriculture more profitable so that existing farmers lead a better quality of life and more young people get attracted to this profession.
10.5.2 Existing pro- farmer policies.
10.5.3 Four Is - Irrigation, Infrastructure, Investment and Insurance sectors
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