



AGRICULTURAL KNOWLEDGE INFORMATION SYSTEMS AND INNOVATIONS FOR TECHNOLOGY DISSEMINATION AND SUSTAINABLE AGRICULTURE DEVELOPMENT

Saravanan RAJ

Associate Professor (Communication) &
In-Charge, School of Social Sciences
College of Post Graduate Studies
CENTRAL AGRICULTURAL UNIVERSITY
Umiam, Barapani – 793 103
Meghalaya (State), INDIA
saravananraj@hotmail.com

Abstract — Achieving food security and environmental issues become greatest challenge of humankind. Further, natural resources are almost reaching its limit and hence there is a global call for optimum utilisation and also conservation of natural resources. In this existing scenario, sustainable natural resources management heavily relies on sound sustainable agricultural practices. The sustainable agricultural practices dissemination, diffusion and adoption depend on agricultural knowledge information systems. To disseminate sustainable agricultural knowledge and technology, worldwide agricultural extension systems are undergoing a great transition. Efforts for reforming national extension systems are underway. At the same time, the agriculture knowledge infrastructure is evolving in a big way with the emergence of pluralistic extension providers and innovations to disseminate sustainable agricultural technologies to the farming community. A research study was conducted in India to compare the extension objectives and nature of the farm technologies disseminated by the public extension, agri-business firms, agricultural consultancies and Non-Governmental Organisations (NGOs) indicated that a great majority of the farmers had favourable perception towards the technologies transferred by the NGOs. Because, NGOs' extension personnel disseminated location and client specific, need based, locally feasible technologies with more emphasis on local wisdom and traditional knowledge blending with the low input modern farm technologies. The technological attributes wise perception of the clientele were also documented. Further, this article make an attempt to review and analyse recent developments in sustainable farm technology delivery systems and reform measures such as; decentralization, privatization, demand driven and participatory approaches in farm technology delivery. Further, this article highlights the innovations for sustainable technology dissemination and diffusion such as; farmer to farmer extension, single window extension delivery, integrated and broad based extension, gender specific extension, farmer participatory research and extension, validation, refinement and integration of indigenous knowledge systems with modern farm technology, self help group (SHG) approaches, grass root institutions, multi agency extension, market extension, environmental extension education, extension plus approaches, public-private-NGO partnerships and information and communication technology (ICT) initiatives.

Key words : Agriculture, Extension, Dissemination, Innovations, Knowledge, ICT.

INTRODUCTION

Extension education as a 'Social innovation' and prominent force in agricultural change has been developed over the centuries around the Globe (Jones and Garforth, 1997). Visible extension efforts started during 1900s as rural development initiatives for the all round development of individuals (Saravanan, 2003). During 1960's and 1970's public extension dominated almost all the developed and developing countries. But, the 'monopoly' of public extension slowly diminishing from 1980's with the emerging elements of privatization and diversification in the supply of extension services (Carney, 1998; Saravanan, 1999). Recent years 'pluralistic extension' is widely recognized in most countries. Due to functional and structural adjustments in extension approach, the noble objective of extension is the development of an individual, which has been diluted and changed over the years through dominance of 'transfer of technology' approach and emergence of 'pluralistic extension' (Saravanan and Veerabhadraiah, 2003). Existence of public, private and NGOs extension also result in duplication of efforts. Further, to redesign the public extension objectives requires generation of information about public, private and NGOs extension objectives and offerings. Hence, a research study was conducted to understand the objectives and offerings (attributes of the technologies disseminated) by the selected public, private and NGOs extension.

METHODOLOGY

Locale of the study: The research was conducted in Chitradurga, Kolar and Tumkur districts of Karnataka State, India.

Selection of extension organizations and sample size: Based on purposive and random sampling methods, public extension (extension by the Department of Agriculture of the State Government), private extension organizations (Agri-Business Firms and Agricultural Consultancies) and NGOs have been included for the study.

Selection of clientele: The farmers who have direct contact with the selected public and or private extension service organization and also getting agricultural extension service were selected randomly. Considering number of extension personnel working in field level, one client for each extension person was selected randomly in Farmers' Contact Centers. But in private extension system, comparatively less number of extension personnel and clientele were available. Hence, two clientele for each extension personnel were selected. Thus total of 60 clientele from public extension, 90 clientele from private extension (60 from Agri-Business Firms and 30 from Agricultural Consultancies) and 60 clientele from NGOs were included for the study.

RESULTS

Table: 1. Objectives of the Extension Organizations as Perceived by the Clientele of the Public, Private and NGOs - An Analysis (n=210)

Public Extension	Private Extension		NGOs
	Agri-Business Firms	Agricultural Consultancies	
Major objectives			
-Dissemination of agril.information/ technology transfer	- Extension service through contract farming	- Technology transfer /agril. information dissemination	-Developing local self help organizations/ groups
- Organizing	-Market intervention	-Organizing training programmes for farmers	-Empowerment of farm women
		- Timely supplies	-Developing leadership ability of rural people
			-Technology transfer, training

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training programmes for farmers	-'Empowerment'
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OBJECTIVES-AN ANALYSIS

Increasing productivity of agricultural crops	Increasing productivity of processing varieties	Solving Agricultural problems	Solving clientele problems Holistic approach including Human Resource Development and environment
-Partial Tech. /information provision + some time input supply+ training	-Partial Specific crop extension + input supply + market intervention	-Partial Extension + Input supply for Hort. Crops +Market intervention	-Integrated Extension + Input supply for all Crops+ Market intervention + creating self/ off season employment etc.
Disseminating Knowledge	Disseminating Knowledge	Disseminating Knowledge	Disseminating Knowledge + Generating Knowledge (ITK)
Centralized Directive	Centralized- Directive	Decentralized- directive & participatory	Decentralized - Non directive & Participatory
Material /economic development	Material /economic development	Material /economic development	Material /economic + Educational + social & cultural development
Transfer of technology objectives	Commercial objectives	Profit maximization objectives	Development and Empowerment objectives

The public extension system generally perceived as an agency for technology transfer, training, increasing income of the farm family through timely supply and services which in turn increases the nation's food grain production and also it act as a two way channel through which it brings farmers problems', needs to the research system (feedback) for finding solution and developing appropriate technology for the farming community.

Whereas, agri business firms mostly concentrates on specific crops, which will be useful for their export / processing industries and they concentrate technology transfer to the particular crops with assured market intervention. Agri business firms also provide the timely supplies to ensure quality and quantity of produce. Farmers also perceived that extension service of agri-business firms increases the income of the farm family.

Agricultural consultancies mostly concentrates on improved technology transfer along with supply of required inputs for clientele. Clientele benefit linked with the survival of private consultancies. Hence, they are taking responsibility for clientele success for better income. Further, consultancy also takes care of marketing facilitates and increased market price for the clientele produce. Private consultancies are also organizing need based, timely, location specific demonstrations for their clientele, to impart recent technological innovations, mainly on plant protection aspects.

The NGOs mostly concentrate on developing new forms of local people's institutions like; Self-Help Groups (SHGs), empowerment of farm women and developing leadership ability of rural people. The NGOs objectives aims for 'empowerment' through holistic approach in rural development.

Table 2. Attributes of the Technology as Perceived by the Public-Private-NGOs' Clientele

Innovation Attributes	Public Extension	Private Extension		NGOs
		<i>Agri. Business Firms</i>	<i>Ag. Consultancy</i>	
Relative advantage	Low-Medium Blanket Recommendations	Medium-High	High	Low-Medium
Complexity	Medium-High	High	Medium-High	Low location specific and indigenous knowledge
Observability	Medium -High	Medium -High	Medium -High	Medium -Watershed, drip irrigation, agro-forestry -Bio-fertilizer, bio-pesticides
Compatibility	Less	Less	Medium	High
Trialability	Medium	Low	Medium	High
	-Transfer of Technology (ToT) -Limited scope for Innovations	-Market led innovations -Market entrepreneurship	-Market led innovations -Market entrepreneurship	-Farmer led innovations -Social & environmental entrepreneurship

Relative advantage

Half proportion of the Public extension clientele perceived low level of relative advantage, it might be due to the fact that most of the technologies recommended by the Public extension personnel were not client-specific and they are blanket recommendations. Public approach is mainly to promote technologies probably without taking past and future into consideration. The clientele had feeling that many times pest and disease control measures were not yielding expected results. Nearly one-fourths of clientele expressed medium and high level of relative advantage mainly due to the fact that they might be adopted improved practices such as; sprinkler irrigation, orchard development, diversification of farm activities. Three-fifths of agribusiness firms clientele perceived, technologies had low relative advantage. This was mainly due to the fact that, agri business firms though contract farming only ensures assured prefixed price for produce and clientele never get the increased product price. Again, most of the clientele were growing gherkins as a contract crop, which was more labour intensive, it demands continuous labour and supervision, in turn cost of cultivation comparatively more.

Interestingly, great majority of the clientele of agricultural consultancies perceived high level of relative advantage, it may be due to the continuous guidance on soil and water testing, land development, seed selection and sowing, all operations up to harvest, then marketing of produce at better price, all the activities done by the consultancy extension personnel. Because of the highly farmer specific and regular technical service increases the income of farmers through adopting improved practices from seed to harvest. Consultancy aims at increasing profit to farmers either by reducing cost of cultivation or by increasing yield and quality which basically needs relative advantage to convince farmers.

NGOs clientele were almost equally distributed in all three levels of relative advantage. Perception of high level of relative advantage mainly due to the self-employment programmes by the clientele with NGOs financial support, most of the watershed area based programmes benefited resource poor farmers. Soil and water conservation practices yielded considerable amount of benefit to the clientele of NGOs. Some of soil and water conservation practices, farmers may not expect returns from short period. Hence, they perceived low and medium level of relative advantage.

Complexity

Majority of the clientele of the public extension, agribusiness firms and agricultural consultancies perceived high and medium level of complexity. This might be due to the fact that these above organisations disseminating recent scientific advancements in agriculture, because of high illiteracy among clientele and newness of technology may makes them very complex to understand and use the improved agricultural innovations. Majority of the NGOs clientele expressed technologies are less complex. This might be mainly due to NGOs giving more importance to location specific and indigenous knowledge. In contrast to this, public extension, private extension personnel laying more emphasis on improved scientific techniques.

Observability

Low level of observability of technologies commonly noticed among the clientele of agribusiness firms and agricultural consultancies. This might be due to the fact that recent technologies such as organic farming, bio- fertilizer application and micro nutrient application may lead to low level of perception of observability. Due to lack of adequate demonstration farms with respect to the advanced technologies may also be a reason for low observability. Generally NGOs concentrating on very few technologies like watershed, drip irrigation, agro-forestry etc., which are more visible than technologies of public and private extension, concentrating on wide range of technologies makes to perceive low, medium and high observability categories.

Compatibility

Generally Public extension, private consultancies, agri business firms suggesting new crops and varieties, plant protection chemicals, which are not regularly practiced by the clientele, which makes them perceive less compatible. But, NGOs concentrating on few technologies, with more emphasis on local wisdom may be the reason for perceiving more compatibility with the technologies. Participatory approaches adopted by NGOs make the clientele to feel the technologies more compatible.

Trialability

NGOs recommending local technologies, which are perceived more feasible and trialable among the clientele. But, public extension, agribusiness firms and private consultancies recommending new crop varieties like horticultural crops with adequate land area and high cost inputs which makes to perceive less trialable among clientele.

Attributes of farm technology

Great majority of the favourable perception towards the technologies transferred by the NGOs might be due to the following reasons; dissemination of location and client specific, need based, locally feasible technologies with more emphasis on local wisdom and traditional knowledge. But, public extension, agri business firms, agricultural consultancies generally transferring wide range of improved technologies, some of which demands high input (high yielding varieties) and high resource potential. Hence clientele perceived less favourable and favourable.

Economic characteristics

Interestingly, public-private extension transferred technologies possess medium level of public good characteristics. It implies that, all the agencies mostly concentrating on toll goods (services having both public and private goods character). Very contrary to the assumption of the experts, private extension technologies also having medium level of public good character. Considerable proportion of NGOs clientele expressed high level of public good character in the technologies, which might be due to the fact that, NGOs are concentrating community oriented/ area specific activities like watershed development, waste land development, agro-forestry. Where as agribusiness firms clientele one-fourths of them perceived public good character (high level of private good character) might be due to the fact that agri business firms' Gherkin and HLL processing tomato variety (Roma) cultivation methods, recommendations are very specific to the contract farmers, not applicable to other crops and other farmers.

INNOVATIONS IN EXTENSION

Group Approach

The public, private and NGO extension moving from individual to group approaches, which facilitates extension planning and implementation. It makes the system more farmer accountable, involvement of groups in decision making, access to credit, value addition, marketing lead to sustainability (Sulaiman, 2003).

Farmers Contact Centre at Grassroot Level

Farmers contact centers by department of agriculture at grass root level facilitates high access for wide range of services such as: farm advisory services, training, market information, weather etc., e.g DoA at Kerala, Maharashtra, Karnataka and Rajasthan.

Women Specific Extension

Information and technology access to farm women also provides entrepreneurship development training, village based institutional training mostly on technologies related to production of crops and generally women self-help groups are formed (Sulaiman, 2003).

Participatory Approaches

For planning of extension interventions, participatory approaches have been widely used for need assessment, implementation, and impact assessment. In the last two decades, application of PRA methods at grass root level was noteworthy.

Single Window Delivery Approach

The approach considers individual family as a unit for development and designs appropriate intervention strategies for sustainable agricultural development. The multidisciplinary team of professionals based in the villages undertake systematic microplanning exercises for understanding development needs of the family. Here the family members participate in designing and implementation of the development plan for the family e.g. BAIF institute of rural development (BIRD).

Farmer to Farmer Communication

The Adike pathrike, a farm monthly started by all India areca growers association to encourage farmer to farmer communication was one of the success stories of farmer to farmer communication (self help journalism) for more than 15 years of existence in agricultural knowledge dissemination. The uniqueness of the publication is that starting from writing articles, editing, publishing and distribution are mainly shouldered by practicing farmers (Shreepadre, 2000).

Self-Help Groups (Peoples Institutions)

Decentralized decision making in extension programme planning and implementation encourages formation of peoples' organizations. These self help groups, farmers associations, societies, co-operatives, groups are used as platforms for promoting decentralized planning, decision making and implementation of projects (Saravanan, 2008).

ICTs FOR AGRICULTURAL EXTENSION

The widespread availability and convergence of Information and Communication Technologies in India, in recent years, have led to unprecedented capacity for dissemination of knowledge and information to the rural population. The experiences of ICT projects in rural India indicated encouraging results in providing agricultural information, education, health and e-governance to the rural population. The ICT projects like e-Choupal, Akshaya, Bhoomi, Drishtee, N-Logue and Krishi Vigyan Kendras of Indian Council of Agricultural Research (ICAR) have shown some promise towards scaling up. The Info-Village Project in Pondicherry facilitated empowerment of rural community. All the projects clearly demonstrate that irrespective of the type of information kiosk, the value addition in the services for rural consumers is the key to the success in scaling up the project. It has been also shown that an appropriate management model in the line of e-Choupal, milk collection centers of Gujarat defining government role in supportive policy environment, institutionalizing the public-private-community partnership model at the grass root level, appropriate and affordable technologies that can be adopted by the end users and increased functional literacy level of rural people can give lead to significant economic activity in large scale. The effective awareness campaign on ICT use, involvement of local self governments, value added information and combination of services provision proved as strategic factors behind success of ICT initiatives. Among ICTs for agricultural extension, Kissan Call Centre initiative of Government of India, e-Sagu (www.esagu.in), e-Arik (www.earik.in), India development gateway (www.indg.in) and e-aAqua (www.aqua.org) are notable examples (Saravanan, 2008; Saravanan, 2010).

CONCLUSION

From the results it is concluded that public extension mainly focusing on 'technology transfer objectives', Agri-business firms' were on 'commercial objectives', agricultural consultancies on 'Profit maximization objectives' and NGOs on 'empowerment objectives'. In public extension, environmental education, human resource development objectives need to be introduced and given more importance. In this, existing scenario, NGOs' 'holistic approach' proves to be better compare to other objectives. The public-private extension transferred technologies possess medium level of public good characteristics. It implies that, all the agencies mostly concentrating on toll goods (services having both public and private goods character). Very contrary to the assumption of the experts, private extension technologies also having medium level of public good character. Considerable proportion of NGOs clientele expressed high level of public good character in the technologies. The public extension concentrated transfer of routine technologies with less emphasis to innovations. The private extension's market led innovations facilitated market entrepreneurship among the clientele and farmer led innovations of the NGOs facilitated the development of social and environmental entrepreneurship among the clientele.

WAY FORWARD

Redefining the Role of Public Extension: There is urgent need to redefine the role of public extension system. Because, private extension providers such as: consultancies, agri-

business and processing firms are increasingly concentrating on select geographical area, crops and clientele. Hence, public extension need to concentrate on resource poor farmers, food security issues, environmental extension and monitoring and regulatory role of extension services.

Promoting Public-Private and NGO Partnership: Pluralistic extension actors encouraged for partnership programmes. Further, appropriate “contracting-in” and “contracting-out” models need to be worked out based on the competency of the extension providers.

Integration of Innovations: Successful innovations in technology dissemination need to be integrated into a larger system.

Scaling-up of ICT Initiatives: Appropriate ICT models for agricultural extension need to be replicated and extensively used for sustainable farm information and technology dissemination.

Beyond Technology Transfer Role: Apart from farm information and technology dissemination, extension providers should concentrate on wider role including input supply, market intervention, and linking farmers for farm credit (Saravanan, 2008).

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