International Journal of Agriculture and Environmental Research

ISSN: 2455-6939

Volume:03, Issue:02 "March-April 2017"

EFFICIENCY OF PARTICIPATORY RESEARCH APPROACHES AMONG SMALLHOLDER FARMERS

Ngozi, S[1*], Mshenga, P[2], Hillbur, P[3] and Kakuhenzire, R[4]

[*1,2]Department of Agricultural Economics and Business Management, Egerton University, Box 536, Njoro, Kenya

[3]Department of Science, Environment, Society, Malmö University, Sweden

[4]International Potato Center, Tanzania, Box 2473, Morogoro, Tanzania

*Corresponding Author

ABSTRACT

Participatory research approaches (PRA) are geared towards planning and conducting research process *with* those people whose life-world and meaningful actions are under study. Thus, the aim of the inquiry and the research questions develop out of the convergence of two perspectives—that of science *and* of practice. It also implies that in the best case, both sides benefit from the research process. Nonetheless, the effectiveness of PRA is under contestation largely because of limited impact of research studies on communities. The study evaluated efficiency and effectiveness of participatory research approaches (PRA) among smallholder farmers in Babati district, Tanzania. In this study, efficiency was viewed as a ratio of output (in terms of number of recipients who become aware of the promoted technologies and ended up using the integrated technologies), to the costs of implementing the participatory research approaches. On the other hand, effectiveness was defined as an ability of participatory research approach to meet its key objectives in this case was reaching large number of farmers and making farmers to adopt the technology in question.

Data on the PRA activities was collected from the organizations implementing agricultural integrated innovations. Six approaches were evaluated: farmer research groups (FRGs), farmer field schools (FFS), mother-baby trials (MBTs), on-farm demonstrations (OFDs), mobile demonstration plots (MDPs) and coupon agro-inputs (CAIs) approaches. Data envelopment analysis (DEA) was employed in which each participatory research approach was treated as a decision making unit (DMU).Two DEA models were estimated using the variable returns to scale (VRS) assumption. The first model considered the number of farmers trained per participatory approach as an output while the second model considered the proportion of adopters as the output. The results revealed that in the first scenario, farmer research groups approach had the highest efficiency (72 percent), followed by mother-baby trials whose efficiency was 71 percent. In addition, on-farm demonstration plots had an efficiency of 67 percent, mobile demonstration plots 63 percent while the efficiency of farmer field schools and coupon agro-inputs was 57 percent and 58 percent, respectively. In the second scenario, the farmer research groups approach led with an efficiency score of 68 percent, followed by on-farm demonstration plots with the efficiency of 60 percent. Coupon agro-inputs and mother-baby trials had the efficiency of 52 percent while the efficiency of farmer field schools mobile demonstration plots was 45 percent and 39 percent, respectively.

The results suggest that resources devoted in implementation of the PRAs under the study were underutilized. This implies that there is still room to improve and optimize participatory approaches and enhance their efficient in use for reaching t target farmers and making them adopters of Integrated Agricultural Innovations.

Keywords: Efficiency, farmer-research groups, Tanzania, variable returns to scale

BACKGROUND

Smallholder farmers in developing countries continue to practice extensive agriculture despite changes in global farming trends and production economics. Inevitably, they continue to encroach on hitherto uncultivated but often marginal or fragile lands and do not have access to production enhancing farm inputs. Consequently, their agricultural productivity is low leading to food and income insecurity and perpetual poverty. To overcome this, there is need to adopt technologies and practices that allow agricultural intensification (Getnet *et al.,* 2012) thereby enhancing productivity. Agricultural innovation is essential to address environmental problems related to poor practices in a world that must soon support more than nine billion humans (Getnet *et al.,* 2012). Most of the current agricultural research initiatives focus on increasing land productivity through provision of improved farm inputs but limited knowledge transfer particularly in developing countries like ub-Saharan Africa. Improved efficiency in the use of land and agricultural inputs is already contributing to attaining environmental protection goals (Befort, 2011). In as much as increasing productivity is necessary, current efforts are not sufficient to ensure food security, reduce poverty, improve nutrition, and maintain the natural resource base for sustainable development. Consequently, innovations across a broader spectrum of policies and technologies are needed to confront the complex array of challenges at the

ISSN: 2455-6939

Volume:03, Issue:02 "March-April 2017"

agriculture-environment nexus (Befort *et al.,* 2011). The aim of agricultural integrated innovations is to maximize and improve productivity in a sustainable manner that would confer more benefits to smallholder farmers than those based on single and often input-based components and productivity improvement initiatives.

In the 1980s, pioneer social scientists proposed the idea of involving farmers more systematically and actively in the research process to take advantage of farmer skills to innovate (Rhodes and Booth 1982). Among the most influential works, Rhoades and Booth (1982) introduced the farmer-back-to-farmer concept which starts by identifying farmers' problems and going back to them with alternatives. Chambers *et al.* (1989) compiled the work of several researchers and introduced the idea of 'farmers first' where farmer participation in agricultural research was justified from different points of view. However, there are different participatory research typologies that include contractual, collaborative and collegial (Biggs, 1989).

In recent years, the concept of farmer participation appears in wider concepts related to innovation systems, which go beyond the farm-gate. This includes, but is not limited to, multi-stakeholder systems such as livelihoods, food systems and value chain analyses (Hall, 2009; Scoones and Thompson, 2009). Participatory approaches were developed in order to put right some of the problems of classical approaches to agricultural research and technology delivery whereby researchers obtain data from communities, study their subjects, and take away data without adequately giving back to local communities who participated in the research (Riano *et al*., 2003). Participatory approaches are therefore, believed to enhance the efficiency of agricultural research in delivering more suitable and easily adoptable technologies and keep continuous interaction between scientists and smallholder farmers. Moreover, participatory approaches allow feedback from farmers to be integrated into the research program reviews. Thus, major responsibilities for adaptive research are devolved to farmers, who also share costs of research (tangible, intangible and in-kind) so that they can demand accountability and transparency from the public research systems (Ashby, 1990).

LITERATURE SUMMARY

The use of participatory approaches in agricultural technology development and transfer is assumed to offer far-reaching benefits to all stakeholders along a developing value chain. Moreover, some authors have even argued that the approach fosters efficiency and effectiveness of research investment and contributes to a process of empowerment of rural farmers (Abdoulaye *et al*., 2012). Many studies have been conducted on participatory agricultural research approaches for technology development, adaptation and dissemination. Among them, Abdoulaye *et al*. (2012) did a study on the use of participatory research approaches in large-scale

ISSN: 2455-6939

Volume:03, Issue:02 "March-April 2017"

dissemination of agricultural technologies. In their study, they used the probit regression model in analyzing the data. The results revealed that projects that employed participation approaches had a positive and significant ($P \leq 0.05$) effect on household food security. The study further revealed that development agricultural interventions that involve multiple stakeholder partnerships, use of participatory research and extension approach can help increase technology adoption among resource-poor farmers as well as increasing farm production and food security (Abdoulaye *et al*., 2012). In another study, the use of participatory processes in large-scale dissemination of conservation agriculture technologies in Zimbabwe, that use of demonstration trials encouraged the most participation and subsequent adoption and adaptation of the technologies to suit specific farmer needs (Pedzisa *et al.,* 2010).

The participatory nature of the process encouraged greater knowledge sharing among farmers and gave them more confidence in the use of the technologies. Further, in a study that evaluating the benefits of farmer field schools (FFS) by comparing potato productivity of FFS participant and non-participants indicated that farmers that participated in FFS had significantly ($P \leq 0.05$) higher potato productivity than non-participants in FFS (Ortiz *et al.,* 2004). Few participatory agricultural research and technology transfer approaches have analysed costs and benefits of the approaches and their overall impacts and spill-over effects. Consequently, this study was undertaken to explore and evaluate the efficiency of the selected participatory research approaches for technology uptake, adoption and enhancement of agricultural productivity.

Review of Participatory research approaches

Mother-baby trials

The term 'mother-baby' was coined by Malawian farmers in 1990's when one of the researchers went to Malawi to introduce the concept but did not have a simple non-technical name for it that could be easily understood by farmers. So a farmer came up and said, "This is a 'mother' trial because it gives birth to other 'baby' trials". Since then, the concept has been known as such Mother-baby-trials (CIMMYT, 2002). Mother trials are researcher-designed and managed trials while baby trials are located around mother trials and consist of a few treatments chosen from the mother trial by the farmers. Therefore, "mother" trials test many different technologies, while the "baby" trials test a subset of three or fewer technologies plus one control (Snapp, 1999). The baby trials allow farmers to see for themselves the performance of treatments at different trial sites and allow for faster and larger-scale testing at different locations under different management conditions (Rusike *et al.,* 2006). The design makes it possible to collect quantitative data from mother trials managed by researchers, and to systematically crosscheck them with baby trials on a similar theme that are managed by farmers (Bellon *et al.,* 2002). In addition,

ISSN: 2455-6939

Volume:03, Issue:02 "March-April 2017"

mother-baby trials are widely being used as communication and dissemination strategy thereby boosting and scaling adoption of different agricultural technologies. For example, the Africa RISING Southern and East Africa project uses the mother-baby trials approach as a communication and dissemination strategy.

Farmer Field Schools

The term Farmer Field Schools comes from the Indonesian expression *Sekolah Lapangan* meaning field school. The first field schools were established in 1989 in Central Java during a pilot season by plant protection officers to test and develop field training methods as part of an integrated pest management (IPM) training of trainers' course. The approach was designed to overcome the difficulty of training small-scale rice farmers on the complex and novel concept of integrated pest management (Gallagher, 1999). Farmer Field School (FFS) usually take place in the fields of participating farmers hence it is a school without walls. The Farmer Field School (FFS) approach is a widely practiced participatory model that integrates farmers into the technology development and transfer process (Ross, 2007). The principal component of any FFS is that it emphasizes experiential learning, with a participatory approach. Hands-on training is important to attract both literate and illiterate farmers and to keep them interested in learning about IPM. Farmer field schools are run by facilitators rather than instructors in order to create a group learning environment rather than a classroom setting with a teacher giving instructions. Godtland *et al*. (2004) investigating FFS for potato farmers in the Peruvian Andes controlled for selection bias and other factors influencing integrated pest management (IPM) knowledge and yield, using a matching propensity score model. The researchers concluded that farmer field schools (FFS) participants have significantly more knowledge about IPM than those who did not participate in farmer field schools (FFS). It was concluded that, increased agricultural knowledge leads to higher yields and FFS participants are more likely to have a higher output on their farms.

Farmers research groups

The main objective of Farmers Research Groups (FRG) is to involve farmers in technology generation, verification and transfer process. The model allows open the participation of farmers in the research system thereby improving communication and information exchange and hence it empowers farmers both technically and economically (Hauli,2007).Farmers research groups act as focal points for on-farm observation, problem identification and prioritization, experimentation, analysis and monitoring together with evaluation of the planned activities. Under this approach, there are attempts to involve farmers in the whole process of technologies development and dissemination. All research efforts are also being directed towards solving the

ISSN: 2455-6939

Volume:03, Issue:02 "March-April 2017"

major priority problems identified. Working with farmer research groups in both livestock and crops research considerably improved communication and information exchange, empower farmers both technically and economically and opened doors for on-farm participatory research approaches (Hailu, 2007). If the farmer research groups approach can be managed properly it can provide a significant contribution to research and development activities of developing countries (Hailu, 2007).

On-farm demonstration

The need for demonstrations was first recognized nearly a century ago by Seaman A. Knapp, an extension pioneer. Knapp's theory was that farmers would not change their methods as a result of observing farms operated at public expense, but that demonstrations conducted by farmers themselves on their own farms under ordinary farm conditions were the answer. In 1903, Knapp proved his point through demonstration on small farms in which half was planted corn and half cotton. Many researchers in developing countries have been employing on-farm demonstrations in evaluation and dissemination of different agricultural technologies. Most of these researchers confirmed the important role of demonstration plots for evaluation and scaling of most technologies. In a study on impact of participatory research approaches specifically on farm demonstration and technology uptake revealed that, when farmers are actively involved in on-farm demonstrations, the demonstrations act as an avenue for the diffusion of new technology (Pedzisa *et al.,* 2010). David *et al*. (1990) did a study on field trials as an extension technique in Swaziland. In their study, the probit model was used to determine factors that influence farmers either participate in the field trials or they do not. The results show that farmers with more land are more likely to be in field trials, presumably reflecting their greater social status. Contrary, the study revealed that, field trial participation is not positively influenced by having a male household head on the farm (*Ibid*).

Mobile demonstration plot

Mobile demonstration plot is an approach that disseminates agricultural technologies through the use of information and communication technologies (ICT) based tools such as tablets and mobile phones. Information and communication technologies can play a crucial role in benefiting the resource-strapped farmers with up to date knowledge and information on agricultural technologies, best practices, markets, price trends, and weather conditions. The experiences of most countries indicate that rapid development of information and communication technologies (ICT), which facilitates the flow of data and information, has tremendously enhanced the knowledge management practice in agriculture.ICT can play a critical role in facilitating rapid, efficient, and cost effective knowledge management. For instance, in a number of Sub-Saharan

African countries, smallholder farmers get technology-related advice as well as location-specific market information on inputs and outputs through ICT-based service such as kiosks. Furthermore, mobile telephone service is being used to deliver agricultural information to users. Using available ICTs does not only improve information and knowledge management for extension workers and farmers but optimize and rationalize public resources devoted to agricultural extension services (UNDP, 2012).The rapid spread of mobile phone coverage in developing countries provides a unique opportunity to facilitate technological adoption via ICT-based agricultural extension programs. In Tanzania, Farm Africa implements the sesame production and marketing project with the aim of improving income for small holder farmers. The project employed an ICT-based tool to disseminate agricultural technologies to farmers. Specifically, the project employed tablets in delivering different agricultural technologies such as land preparation, plant care, harvesting and post-harvesting to farmers (Farm-Africa, 2015).Therefore, to speed up agricultural technology adoption, the governments of developing countries including Tanzania need to quickly review and modernize the public agricultural extension service delivery system.

Study description

Six participatory research approaches namely farmer field schools, farmer research groups, coupon agro-inputs, mother-baby trials, on-farm demonstrations and mobile demonstration plots were evaluated. Secondary data were collected through documentary analysis from the Farm Africa, Africa RISING and Babati district agriculture offices. The documents that were analyzed include budgets, expenditure statements to estimate the cost incurred in running the participatory research approaches and the number of adopters. The costs data collected were on researchers' allowances, expenses incurred during field visits, price of seed and fertilizer, labour, training and field days. Determining how many farmers each approach reaches for a given budget requires information on the number of people who participate in the various types of training. Information on the number of attendees at each training session was obtained from the institutions that sponsor each participatory research approach (PRA). Statistics on how many people were reached by mother-baby trial were obtained from the Africa RISING project office in Arusha. Data on the reach of mobile demonstrations was obtained from the Farm Africa sesame project coordinator. Data on number of farmers reached by farmer research and the costs were obtained from Farm Africa on their farmer participatory approach project.

Data Analysis Technique

Data envelopment analysis (DEA) was employed in which each participatory research approach was treated as a separate decision making unit (DMU). Two data envelopment models were applied using the assumption of variable returns to scale (VRS): Model one considered the number of farmers trained per participatory research approach as the output, while model two considered the proportion of adopters as the output. Efficiency in data envelopment analysis model was defined as the ratio of the weighted sum of outputs to its weighted sum of inputs. Given *s* outputs and *m* inputs, efficiency (*h*i) for a decision making unit is defined as follows:

Max u, v

$$h_i = \frac{\sum_{r=1}^{s} Ur1Yr1}{\sum_{j=1}^{m} Vj1Xj1} \quad (1)$$

Subject to:

$$\frac{\sum_{r=1}^{s} Ur1Yr1}{\sum_{j=1}^{m} Vj1Xj1} \quad (2)$$

Where:

h_i= Technical efficiency to be estimated

Y_r=Quantity of outputs

U_r =Weight attached to output

V_j= Weight attached to inputs

i = indicates the n different units

r=indicates the s different outputs

j= indicates the m different inputs

RESEARCH APPLICATIONS

Data envelopment analysis model results

Table 3 reports the results of Data Envelopment Analysis (DEA) model. The findings revealed that the mean technical efficiency for six PRAs was 0.64 and 0.53 in VRS model for the first and second models respectively. The results further showed that in the first scenario, farmer research groups approach had the highest efficiency, followed by mother-baby trials. In the second scenario, the farmer research groups approach also had the highest efficiency score which

ISSN: 2455-6939

Volume:03, Issue:02 "March-April 2017"

followed by on-farm demonstration plots. From these findings, it can be seen that all the participatory research approaches were below the efficiency score of 1 which implies that the PRAs were inefficient in both reaching their targeted number of farmers and making them to become adopters of the agricultural integrated innovations in the study area. This implies that there is still a room for the NGOs and institutions running these PRAs to increase both the number of farmers trained and the adopters of the AIIs for each participatory research approach using the current levels of resources.

These results are in line with Murage *et al*. (2012) who reported that with respect to number of farmers reached, field days (FD) had the highest efficiency score (90 percent), followed by FFS whose efficiency was slightly above 60 per cent and finally field teachers (FT) with efficiency of 40 per cent. In the second scenario with adopters as an output, FT had the efficiency score of 70 per cent, followed by FD 58 per cent and finally FFS 52 per cent. In their study, they generally concluded that the pathways were operating below the efficient scale. In addition, Khan *et al*. (2009) reported that the average technical efficiency by farmer teachers (FTs) approach was 78 percent while that of farmer to farmer extension was 71 percent. Their findings suggest that the interviewed farmers operated below the frontier output levels. Further Ogunniyi (2012) reported that, the maize farmers were not technically efficient. This is because the farmers operating in their farm with the mean efficiency of 56.9 percent and 64.9 percent under constant returns to scale (CRS) and variable returns to scale(VRS) specification, respectively. This indicates that there was 43.1 percent and 35.1 percent allowance for improving efficiency for the maize farmers.

Table1: DEA Efficiency Scores of Participatory research approaches

Participatory research approach	Model one: Efficiency score	Model two: Efficiency score
On-farm demonstration plots	0.67	0.60
Farmer field schools	0.57	0.45
Coupon agro-inputs	0.58	0.52
Farmer research groups	0.72	0.68
Mother-baby trials	0.71	0.52
Mobile demonstration plots	0.63	0.39
Average	0.64	0.53

CONCLUSIONS AND POLICY IMPLICATIONS

From the study, it was found that the most efficient participatory approach amongst the PRAs studied in terms of both targeted farmers and making them to become adopters of agricultural

ISSN: 2455-6939

Volume:03, Issue:02 "March-April 2017"

integrated innovations, was the farmer research group model. However, none of the PRAs had an efficiency level of 1, which indicates that resources devoted in implementation of the PRAs under the study were underutilized; therefore there is still room for improvement in terms of reaching the number of target farmers and making them to become adopters by using the current available resources. Since the farmer research group model had the highest efficiency, governments, donors and other stakeholders should explore this model in transferring agricultural technologies. In addition, the model could be useful for starting collegial research to improve management of a target crop or problem developing key extension messages with farmers' involvement and understanding how to communicate these messages most appropriately. Since the mobile demonstration plots approach reaches many farmers at a very short period of time, it can be used to disseminate key extension messages more widely.

ACKNOWLEDGEMENT

This article is a summary of a MSc thesis in Agricultural Economics by Semeni Ngozi at Egerton University. The authors acknowledge the USAID funded iAGRI program in Tanzania for financing the study. We also acknowledge RUFORUM, IITA, Africa RISING, district officials and farmers in Babati for the support in carrying out the fieldwork.

REFERENCES

Abdoulaye, P. S., Olanrewaju, A. S. and Ellis, J.2012. Promoting the adoption of innovations through participatory approaches: Example from northern Nigeria. *International Journal of Agricultural Research*, 30 (3): p155.

Ani, A. O., Ogunnika, O. and Ifah, S. S. 2004). Relationship between Socio-Economic Characteristics of Rural Women Farmers and Their Adoption of Farm Technologies in Southern Ebonyi State, Nigeria. *International Journal of Agriculture & Biology*, 6(5): 802-805.

Ashby, J. A. 1990. *Evaluating the technologies with farmers, a handbook*. CIAT Publication No. 187 Cali, Colombia: Centro Internacional de Agricultural Tropical (CIAT): 95.

Biggs, S. D. 1989. *Resource-poor farmer participation in research: A synthesis of experiences from nine national agricultural research systems.* The Hague: International Service for National Agricultural Research.

Bellon, M. R. and Reeves, J. (Eds.). 2002. *Quantitative Analysis of Data from Participatory Methods in Plant Breeding*. Mexico, DF: CIMMYT.

ISSN: 2455-6939

Volume:03, Issue:02 "March-April 2017"

Doss, C. R. and Morris, M. L. 2001. How does gender affect the adoption of agricultural innovations? The case of improved maize technology in Ghana. *Agricultural Economics*, 25: 27-39.

Getnet, A., Mesfin, D., Hanson, J., Anemut, G., Mengistu, G. and Mengistu, A. 2012. Retrospects and prospects of forage and pasture crop research in Ethiopia. Ethiopia institute of agricultural research, Addis Ababa, Ethiopia. Pp 7-14.

Hall, R.E. 2009. By how much does GDP Rise if the Government Buys More Output? Working paper 15496.

IICD. 2013. Youth, ICTs and Agriculture: Exploring how digital tools and skills influence the motivation of young farmers in Eldoret, Kenya. A Research Report on the ICT for Development.

Jamsari, H., Jasmine, A.M. and Norhamidah, J. 2012. Factors associated with the continuality of agricultural innovation adoption in Sabah, Malaysia. *Journal of Sustainable Development*, 5: 47-54.

Khan, Z. R., Midega, C.A.O. and Nyangau, I.M. 2009. Assessment of Technical Efficiency of Farmer Teacher in the Uptake and dissemination of Push-Pull Technology in Western Kenya. *Proceedings of the 25th Annual Meeting, Intercontinental San Juan Resort, Puert Rico*.

Max, N. A. 2015. Effect of farmers' socio-economic characteristics toward adoption level of agricultural technology in Sigi Regency Indonesia. *Journal of Applied Sciences,* 15: 826-830.

Murage, A.W., Obare, G., Amudavi, D. and Khan, Z. 2012. Efficiency of Push-pull technology dissemination pathways for stemborer and striga control in Western Kenya: Data envelopment analysis approach. Paper presented on "Resilience of agricultural systems against crises" Tropentag, Gottingen - Kassel/Witzenhausen Sept 19th-21st 2012.

Ogunniyi, L. T. 2012. Fertilizer use efficiency of maize producers in Ogun State of Nigeria. *The Pacific Journal of Science and Technology*, 13(2): 370-376.

ISSN: 2455-6939

Volume:03, Issue:02 "March-April 2017"

Okwu, O. J. and Umoru, B. I. 2009. A study of women farmers' agricultural information needs and accessibility: A case study of Apa Local Government Area of Benue State, Nigeria. *African Journal of Agricultural Research*, 4 (12): 1404-1409.

Ortiz, O., Garrett, K. A., Health, J. J. , Orrego, R. J. and Nelson R. J. (2004). Management of potato-late blight in the Peruvian Highlands: Evaluating the benefits of farmer field schools and participatory research. *Journal of Plant Disease*, 88(5): 565-571.

Pedzisa, T., Minde, I. and Twomlow, S. 2010. The use of participatory processes in wide-scale dissemination of micro-dosing and conservation agriculture practices in Zimbabwe. Contributed Paper presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa.

Probst, K. J., Hagmann, T.and Fernandez, M. 2000. Developing a framework for participatory research approaches in risk-prone environments. *Paper presented at Eutscher Tropentag, University of Hohenheim, and Stuttgart, Germany*.

Rehman, F. Muhammad, S. and Ashraf, I. 2013. Effect of farmers' socioeconomic characteristics on access to Agricultural information: empirical evidence from Pakistan. *Journal of Animal and Plant Sciences*, 23(1): 324-329.

Rhoades, R. E. and Nazarea, V. 2006. Reconciling local and global agendas in sustainable development: Participatory research with indigenous Andean communities. *Journal of Mountain Science*,3 (4): 334–346.

Rhodes, R.E. and Booth, R.H. 1982. “Farmer Back to Farmer”: A Model for Generating Acceptable Agricultural Technology. Agricultural Administration, II: pp. 127-131.

Riano, D., Chuvieco, E., Salas, J. and Aguado, I. 2003. "Assessment of different topographic corrections in Landsat-TM data for mapping vegetation types (2003)," in *IEEE Transactions on Geoscience and Remote Sensing*, vol. 41, no. 5, pp. 1056-1061.

Selener, D.1997. Participatory action research and social change a source book. Ithaca, New York: Cornell University.

ISSN: 2455-6939

Volume:03, Issue:02 "March-April 2017"

Scoones, I. and Thompson, J. 2009. *Beyond farmer first: Rural people's knowledge, agricultural research, and extension practice*. Intermediate Technology Publications: London.

Shiferaw, B., Obare, G. and Muricho, G. 2006. Rural Institutions and Producers Organizations in Imperfect Markets: Experiences from Producer Marketing Groups in Semi-Arid Eastern Kenya. *CAPRI Working Paper 60*. Also jointly released as *ICRISAT Socioeconomics and Policy Working Paper Series No.23.Patancheru, Andhra Pradesh.*

Xiaolan, F. and Shaheen, A. 2012. Impact of mobile telephone on the quality and speed of agricultural extension services delivery: Evidence from the Rural e-services Project in India. *International Association of Agricultural Economists (IAAE) 2012 Triennial Conference, Foz do Iguaçu, Brazil*.

