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Special Article

Studying Agricultural Knowledge and Information Systems for Improving Agricultural Extension

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One of the first studies of an agricultural knowledge system was made in India (Nagel, 1980) based on theories of Havelock (1969). Later important contributions to this field have been made in the USA, e.g. by Interpaks (Swanson and Peterson, 1989) and in Europe, e.g. by Roling (1988, 1990, 1991). A valuable earlier study had been done in England (Scoullar, 1978), but this study is hardly ever quoted. Information can not only be generated, but it can also get lost.

An agricultural knowledge and information system (AKIS) analyses, who contributes which kind of knowledge and information to decision making in agriculture and what are the relationships between different actors in this system. Studying this system is useful in order to be able to manage this AKIS in such a way that it contributes as much as possible to generation, dissemination, transformation utilization, storage and retrieval of knowledge and information which is useful for agricultural development (See Roling and Engel, 1991).

One can discuss at length what is the difference between knowledge and information, but these discussions do not help us very much. The knowledge we have in our heads, can not be transferred to others unless it is first transformed in words or pictures. This will be information to the others when it decrease their uncertainty, that is when it helps them to understand and predict better what the results of their actions will be.

An AKIS can be studied for a certain region or for a certain field of agriculture, e.g., dairy farming in Gujarat. The major aim of such a study is to be able to suggest how the functioning of this system can be improved in order to increase the competence of farmers to produce with their resources what the market requires at a low cost. This competence is of crucial importance for agricultural development. Knowledge and understanding of an AKIS can also support the decision making by other actors in the process of agricultural development.

A basic assumption in studying an AKIS is that information relevant for decision making is generated by different actors and reaches farmers in many different ways. Often to solve a problem research findings from different disciplines discovered by researchers at different institutions has to be combined. But not only researchers generate information; very important information is generated by farmers. The

farmer, who makes a decision, has important information about his resources and ability and ability and willingness to bear risks, the quality of his land, the labour requirements on his farm in different seasons, the possibility to hire labour, his experiences, etc. Usually he does not get the most important information from government officers, but from other farmers, who have tried and modified innovations, who make their own experiments and develop new farming systems and who have collected over generations a treasures of indigenous knowledge. McDermott (1987) has shown clearly that the development of new agricultural technologies requires a rule a close cooperation between researchers, extension agents and farmers. Often a new technology is only profitable when a farmer changes his farming system. If a farmer replaces his oxen by a tractor, he may also have a employs and several other aspects of his farming system. As a rule farmers play a larger role in developing this new farming system than researchers. This can not be studied at research institute, but only on farms.

Information on policies is generated in different government agencies. Private dealers and cooperatives have valuable knowledge on input supply and markets, which may be much more important than information from research. The strength of the research and extension branches of these companies is rapidly increasing.

This implies that the technology transfer models in which technology is developed by researchers, transferred to farmers by extension agents and utilized by farmers need is often an increase in their competence to obtain and utilise information from many different sources. The integration of the information from these sources will usually be made by the farmer as a decision maker, but some of this integration can also be done elsewhere in the AKIS, e.g. at the fortninghtly training of VEAs. Each actor in an AKIS will usually collect information from different sources, evaluate, transform and integrate this information before he passes some of this information on to other actors.

RELATIONSHIPS AMONG ACTORS IN AKIS

One way to study an AKIS is to analyse who contributes knowledge and information to this AKIS and what are the relationships between these actors. Research has shown quite clearly that communication is much more effective when it starts with problems which farmers consider important than when it starts with solutions which what researchers or government officers consider useful for farmers (Windahl and Signitzer, 1991). This deficiency is now recognised by top level administrators in the agricultural extension service (Macklin, 1992). At the request of the Joint Secretary (Ext.) in the Ministry of Agriculture, Manage develops models for a more participatory extension system. Implementing these models would result in a major change in the Indian AKIS. Extension scientists should play a role in realising this change by studying successful experiences with more participatory extension approaches of NGOs as well as of the public extension system and by analysing where a participatory approach to extension is necessary (Hayward, 1989).

Often there is no direct interaction between different actors in the AKIS, but an indirect interaction through a chain of others.

The official way for Haryana farmers to communicate their needs for new information and their experiences to CSSRI researchers is through :

1. ordinary farmers,
2. contact farmers,
3. (Village) agricultural development officers,
4. SMSs of the State Development of Agriculture,
5. SMSs of Haryana State Agricultural University,
6. Researchers at Haryana SAU,

7. CSSRI researchers.

Not each step in this chain will convey all the information it received to the next step. Not all information which the ADOs report at the fortnightly training reaches the Monthly Workshop. Suppose that at each step 20 per cent of the information is lost, than in the end 74 per cent is lost. In a case where at each step 50 per cent is lost, only 1.5 per cent reaches CSSRI researchers. Even more important may be selection which information is transferred to the next level and which is not. There are perhaps 10 million farm families whose experiences are important for CSSRI researchers, but this flow of information is unmanageable unless it is consolidated at various intermediate steps. However in this consolidation process important information can get lost.

One way to decrease these losses can be to use shortcuts. The staff of the Extention Group at CSSRI can e.g. listen very carefully to the experiences farmers have with technologies which are (partly) based on CSRRI research findings and communicate this information directly to their colleagues in other Divisions. This requires that they are well informed about all research which is done at their Institute. A difficulty is that the number of farmers from whom the three staff members in this group can collect information, is much smaller than the number from whom the 80,000 Village Extension Workers in the country can collect information. Also a well planned use of mass and A.V. media can help to reduce these losses.

ICAR Institutes and SAUs have their own extension programmes for farmers, next to the programmes of the State Departments of Agriculture. With their Lab to Land Programme, operational activities they can reach only a tiny proportion of the Indian farmers. For instance during the Seventh Plan about two out of every 100,000 farm families participated in the Lab to Land Project (Report 1988). Therefore one can wonder whether the main goal of these programmes should be to increase the competence of farmers or to increase the competence of researchers by bringing them in direct contact with some farmers. These extension programmes could also strengthen the training programmes for the staff of the State Departments of Agriculture by showing the trainees which results can be obtained in farmers fields (Samanta, 1991).

In order to solve an agricultural problem usually information which is generated by different actors, has to be integrated. It is useful to study where and how this process of integration takes place and to analyse whether this process can be improved. Chambers (1988) discovered that there are often weaknesses where different disciplines or different organizations have to work together to solve a problem. How is e.g. information about market opportunities and about research findings on plant varieties integrated?

Also in the process information has often to be transformed. A researcher might e.g. discover that increasing the amount of N applied to a wheat crop of four weeks old from 30 to 50 kg N per ha results in an increase in yield of 150 kg. A farmer, however, does not work with kg N, but with bags of urea and perhaps not with ha, but with a field of an irregular shape Transformation of information is needed to enable him to use the optimal amount of N.

Rolling (1990) has mentioned also a number of other ways which can be used fruitfully to study an AKIS.

WEAKNESSES IN THE SYSTEM

Research in engineering tries to develop more productive technologies by using research findings from scientific disciplines like physics which try to give us a better knowledge and understanding of

nature. In a similar way extension education tries to design more effective extension organizations and methods by using research from social sciences which try to understand human behaviour. One of the ways in which extension scientists can perform this role is by studying the AKIS. Their objective is not only to understand how the AKIS works and why it works in this way, but also to indicate what can be done to make the AKIS more effective. In this way we try to assist the people who are responsible for the management of (parts of) the AKIS.

The study of an AKIS should focus on points where improvements might be possible. Roling (1990) has mentioned a number of common disorders in AKISs. I will mention a number of points, where it is my impression that improvements are possible in the Indian research and extension system. I hope that this will help researchers to study the most crucial aspects of an AKIS by studying whether my hypothesis that on these points improvements are possible, is correct and by discovering ways to realise these improvements. A disadvantage of this approach is that the reader might get the impression that I think that research and extension are functioning poorly in India. I am convinced that they have made a very important contribution to the increase in food production in the past 30 years. There is also no doubt that the linkage between agricultural researchers and farmers is now much better than it was in 1966, when I visited India for the first time. However, I do not know any government organization which works perfectly. The Indian agricultural research and extension system is no exception. Furthermore if the system had worked perfectly i the past, it would not work well in the future, if it continued to work in the same way, because the situation is changing.

Agricultural researchers have often not given enough attention to the fact that most farmers are resources poor and cannot bear much risk. Extension agents have often not introduced this information clearly enough in the process of formulating extension recommendations. As a result for many farmers it was a wise decision not to follow these recommendations. In order to be able to improve this situation we should understand why researchers and extension workers are working in the present way. What advantages would it have for them to change their behaviour, unless the system of promotions and other rewards changes first? One should also look for situations where researchers and extension agents have given serious attention to problems of resource poor farmers and analyse why this happened there. There are undoubtly changes in this direction at some of the Zonal Research Stations and with several of the NGOs.

Scientists at State Agricultural Universities make their training of SMSs much more use of their own research than of the work of other researchers, e.g. at ICAR institutes, even if the work of these scientists is quite relevant for solving farmers' problems. This is quite an understandable reaction, but it is not in the interest of the farmers.

The present procedure of selecting SMSs does not guarantee that they are really competent in their field of specialisation. The best scientists are often not willing to work with extension agents in the Zonal Research Stations, but prefer a job at the main campus of the University. The SMSs do not try enough to learn from the experiences of farmers, although this information is quite important to give Village Extension Workers the training they need to be able to help their farmers.

In some states, like Haryana, most Village Extension Workers have a B.Sc. in Agriculture. With the selection of students of SAUs this implies that they often have an urban background and it seems that many of them do not like to associate with farmers on whom they look down. In other states, e.g. Andhra Pradesh, many VEWs do not have enough training in agriculture to really be able to adjust what they learn during their in-service training at the needs of their location. It seems that the extension system works better in West Bengal,

where most VEWs are graduate from agricultural high schools, who have been raised in the village. Also the experience of the Aga Khan Foundation in working in tribal areas with local volunteers, who have been selected by the other villagers to help them after receiving extra training.

In the past extension services supported nearly only decisions of individual farmers. In the present situation collective decisions become more and more important. Large tracks of land are threatened to go out of production as a result of salinity. This can be prevented through drainage, but only if farmers decide together to install a drainage system. Elsewhere the irrigation system is endangered by the falling watertable through overuse of tubewells. An individual farmer can not solve these problems. Also watershed development and soil erosion control and Integrated Pest Management require collective decision making. With the change towards a market economy the organization of marketing and input supply through cooperatives becomes more important. The public extension system has little knowledge and skills of the ways in which it can support this process of collective decision making we need a new organization of the AKIS, which makes e.g. full use of the indigenous knowledge of the formers. The time it takes to reorganise this AKIS, can be reduced if leaders of research and extension organizations try to manage this change in a systematic way.

ICAR realises that it needs for its research more social scientists, who cooperate closely with the present research staff (Raman a.o., 1989). It is doubtful, however, whether the present education system can provide the right kind of scientists for this task. Many universities train sociologists and psychologists, but they are not trained to cooperate with biologically oriented agricultural scientists. In State Agricultural Universities these subjects are often taught by agricultural graduates with some knowledge of, but no thorough training in, social sciences theories and methodologies. In other countries agricultural universities hire for this purpose social scientists, who in their new environment often, but not always, learn well to cooperate with agricultural scientists.

There are also basic differences in the way in which social and biological scientists look at agricultural problems, but these differences are often not discussed openly. A social scientists will often take a more wholistic and less analytic point of view than a biological scientist.

A serious problem is the rapid rate of transfer of Indian government of officers. VEWs often do not stay long enough in a village to understand the specific problems of the farmers in this village and to gain their confidence. At the top IAS officers are often transferred within a year. That makes it impossible to plan for a long term development process based on a thorough knowledge of the agricultural situation and the possibilities to improve this situation. There is a real danger that if an officer develops a good plan, it is not implemented but changed by his successor. At the same time agricultural development can only be realised through a long term process of change in which the farm families play a major role.

It seems that the management system in the Indian government is based to large extent on distrust in its staffmembers. This may have been the right way to realise the goals of the colonical government, but it makes development, which should be based of confidence between government officers and villagers quite difficult (Taylor a.o., 1965 : Ch. 23).

VOCATIONAL AGRICULTURAL EDUCATION

The success of agricultural development in Europe is to a large extent due to the vocational agricultural courses and schools which most farmers have followed. Without such an education a

country is not able to built the competence among its farmers, which is necessary to be able to compete with farmers in other countries. The low adult literacy rate in India is a serious bottleneck for agricultural development; in 1990 this rate was 48 per cent in India, 77 per cent in Indonesia and 93 per cent in Thailand (Human Development Report, 1992). In rural areas and among farm women this rate is quite low. India has a large number of university graduates, but so far not much money has been invested in the vocational education of its farmers. A large proportion of the budget for education is now spent it to become quire scarce.

It could be very useful for an Indian to study European systems of vocational agricultural education, not only the systems which are in use now, but especially the systems which were used in the first half of this century. At present a boy or a girl in Europe who likes to become a farmer, might spend 14 years in school to be trained properly for this job. Few Indian farm families can afford to send their children for so many years to school, but that was also true in Europe before the last World war. At that time successful, less time consuming systems for education farmers have been developed. Studying these systems could help to make a proposal for such a system in India, copying systems which worked well in Europe, will not solve the problem. Also the experience in East Asian countries could provide useful ideas.

USING INFORMATION ON AKIS

The Indian governments pay an army of over three lakhs of people (including support staff) in research and extension organizations. This army should contribute as much as possible to increasing the competence of the farmers. One way to achieve this goal is to study the AKIS. I will give some examples of the ways in which information generated about an AKIS can be used.

1. A person or organization which generates knowledge that can be useful to increase the competence of farmers, should decide where and how he tries to introduce this knowledge in the AKIS in order to reach the potential users most effectively. It is my impression that it is no exception that Indian researchers publish research findings in a way that they can be rather sure that it will not be used, because this information does not reach the potential users or persons who communicate regularly with these users. In many countries agricultural researchers try to have their relevant research findings published not only in scientific journals, but also in farm journals or extension leaflets. Indian researchers are often not rewarded to do so. An illustration is that the over 120 studies on T and V in India have never been synthesised for use by extension administrators. Many studies are published in a way that they will reach only few of these administrators. There are also many useful consultancy reports which are hard to get.

2. The management of an institution which plays a role in an AKIS can use information on this AKIS to decide which role they can best play, assuming that all other actors will continue to play their present role. NDRI is e.g. studying their AKIS in order to decide what they can do to increase the competence of the rapidly growing number of dairy farmers. Clearly they can not do this by communicating directly with these farmers.

3. One can also try to improve the functioning of an AKIS as a whole. For farmers it is important to integrate knowledge on crop and animal production. Where in the system should this integration be realised? Which institutions should cooperate to realise this?

Ghosal (1992) claims that the government provides information to farmers through State Departments of Agriculture, State Agriculture

Universities, ICAR Institutes, Doordarshan and All India Radio, but that much more could be achieved if these agencies tried to support each other as well as possible. What ate the incentives for them to work together in the interests of Indian farmers?

The international experience is that few research and extension organizations provide farmers with the information they need, unless farmers representatives have some kind of control over the functioning of this AKIS (Roling, 1988). Can such a control system be developed in the Indian context, perhaps at first only at the Zonal level?

4. Communication technologies are developing very rapidly. How can new technologies be used most effectively? The experience is nearly always that these systems are used much less than the promoters of these systems expected (Rolling and Kuiper, 1991). One reason is that these systems are developed on basis of the possibilities computers offer or on basis of information available, e.g. simulation models. It would be more effective to analyse first who needs which information and how they receive and use this information at present in order to be able to decide whether or not and how their information needs can be better served with the help of computers. Another problem is that these information needs are changing continuously.

5. The optimal structure of an AKIS depends on the situation. In a situation where it is clear which extension messages are in the interest of nearly all farmers, as well as of the country to be adopted and the authorities know the farmers and their problems well a rather authoritarian structure, like the Indian T and V system, can be used. Where the optimal messages are less clear and the target groups are less well known, like in many rainfed and tribal areas, a much more participatory approach to extension is required (Hayward, 1989).

6. Usually there are people who are responsible for the management of different parts of an AKIS, e.g. research on plant protection or the prices on the major grain markets. Seldom, however, anybody is responsible for the management of the AKIS as a whole.

The present changes in Indian agricultural extension services will decrease some of the problems mentioned above (Macklin, 1992), but probably not solve all of them.

CONCLUSIONS

Many mangers of extension organizations would like to receive more assistance from extension scientists in their efforts to increase the success of their organization. In order to provide this assistance extension scientists should choose research topics, which can provide useful information for decision making in extension organizations. One possibility, not the only one, is to study how an Agricultural Knowledge and Information System functions. How do researchers, extension agents and farmers cooperate in developing new technologies and new farming systems? Which information do farmers need for their decision making? From whom they get this information? What is the communication process between the people, who generate information on a certain topic and those who use it? often it is necessary to integrate information generated by different actors. How and where is this integration realised? Many similar questions could be studied to discover possibilities to improve the functioning of the AKIS. This discovery would give some of the information needed to decide on the actions the extension organization can take to help farmers more effectively and to contribute more to agricultural development.

This article gives several hypotheses on possibilities to improve the Indian Agricultural Knowledge and Information System. Research will not

confirm some of these hypotheses, but by confirming or modifying other hypotheses extension scientists can perform a valuable service to extension managers and to farmers. Scientists who try to understand how an AKIS works by listening carefully to the various actors in this system, often provide more useful information for managers of extension organizations than scientists, who use very refined methods for statistical analyses. The last group runs the danger to study computer output rather than people and it is the behaviour of people what really matters. Analysing an AKIS will often require similar research methods as are used for Rapid Rural Appraisal (e.g. Mettrick, 1993).

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