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Village-Level Studies as a Locus for Research and Technology Adaptation

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Abstract

This paper first discusses several traditions of socioeconomic enquiries in India. It then shows how the Village-Level Studies (VLS) of ICRISAT combine several of the features of the previous traditions in a novel way. The objectives, scope, and results of the socioeconomic observation phase of the VLS are discussed next, followed by a description of the ongoing research and adaptation phase of the studies. The VLS are viewed as a locus for many types of socioeconomic enquiries and adaptive technology development and research efforts. They attempt to impart a grassroots approach to technology development at ICRISAT.

Social scientists involved in empirical research on the rural economy have used a variety of methods to gather their data. In what follows we will briefly review some previous approaches, with special emphasis on the Indian context, and try to highlight their advantages and limitations. The village-level studies (VLS) of ICRISAT combine features of most of these approaches in a somewhat novel way.¹

The Ethnographic Approach of Anthropology

In this approach the researcher himself resides in a village or hamlet, often for more than 1 year, and collects personal observations and data on production technology, economic relationships, customs, religion, demography, and language of a particular community. Due to its enormous scope and the fact that the researcher collects virtually all his data without

the help of interviewers, the scope of the technological and economic data is often limited to a few case histories of particular individuals or families. It is therefore usually not amenable to statistical analysis. This weakness is compensated for by the thoroughness of the data collection, stemming from the researcher's own involvement and from his capacity to view data in the full context of the material and nonmaterial relationships existing in the community. The somewhat standardized approach of anthropologists, supported by anthropological theories, allows a comparison of ethnographies across time and space, and the field derives most of its generalizations from such comparisons.

Special-purpose Surveys of Economists and Sociologists

These professional groups have been more concerned with statistical validation of much more limited hypotheses than anthropologists. The standard advice to a young researcher has usually been to select a fairly specific topic or hypothesis for inquiry and design a sampling frame and questionnaires as economically as possible to answer that specific question. Economy in the scope of the data collection is stressed in order to cover sufficiently large samples for meaningful statistical analyses to be performed. Most often, these studies are confined to one or a few interviews with the

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1. Collection of All India data by the National Sample Survey and the Census Organizations is not covered in this discussion; although such data are frequently used by social science researchers, most data users are usually not involved in the collection phase.

respondents and are carried out by trained interviewers, with more or less supervision by the researcher himself. The main advantage of this approach is the speed and economy with which data to answer a specific question can be gathered and processed. Its major disadvantage is that the data are generally used only once. Anybody interested in answering somewhat different questions than the ones posed will usually find that the data have deficiencies in terms of his own purpose. Since the survey teams are most often recruited on a short-term basis, it is seldom possible to complement the existing data via resurveys.

Farm Management Studies (FMS)

In the 1950s, economists in India perceived an urgent need to collect data on the structure and performance of farm enterprises. In developed countries such data were most often collected through voluntary farm-record schemes that lacked a rigorous sampling frame. The extraordinarily successful FMS of the Ministry of Agriculture via its Agro-Economic Research Centres aimed at collecting such data for selected districts all over India on a systematic basis using trained investigators who visited the homes almost daily during a 2- to 3-year period. Under the scheme, a number of districts were covered twice at roughly 10-year intervals. The inquiries were clearly multipurpose in nature; they provided a common tabulation and reporting framework on farm structure, yields, cost of cultivation, relative profitability of various farm-size groups, input, credit use, etc. The farm management reports and the original data were used by many researchers to answer a wide variety of economic and farm management questions. Despite the often considerable time lags between data collection and reporting, the knowledge gained from these studies has provided major insights that have been widely applied in agricultural policy matters.

The studies, however, were still limited in scope; they did not include agricultural laborers as respondents, nor did they pay much attention to technical and biological aspects of cultivation. They were designed by economists for their own purposes. Also, because the original data were not computerized, access to them was not open to many researchers outside the centers where they were collected.

The FMS were replaced in the early 1970s by the Cost of Cultivation Scheme (CCS). This was done at the request of the Agricultural Prices Commission, which wanted more reliable, rapidly accessible information on the cost and benefits of cultivation of specific crops for price policy purposes. The sampling framework was shifted from an agricultural-area basis to a specific-crops basis, and the task of collection was assigned to the agricultural universities. While the scope of data collection is virtually the same as in the FMS, the reporting is usually restricted to the cost of cultivation of a specific crop. It is unfortunate that the data are not utilized to produce the equivalent of the old Farm Management Reports. Furthermore, the Ministry of Agriculture restricts the use of the data for several years so that the cost of cultivation information can be fully verified before it is released. This reduces the usefulness of the studies to other researchers. A reappraisal of the decision to drop the FMS may be in order now.

The Village-Level Studies Scheme of the Agro-Economic Research Centres (AERC)

The AERCs are usually associated with economics departments of universities and are sponsored by the Directorate of Economics and Statistics of the Ministry of Agriculture. One of their earlier tasks (since the 1950s) was to conduct village surveys that focused primarily on demographic, economic, and sociological structures of these villages. The main purpose of these studies was to find out the structural factors that contributed to or impeded development. Villages were often chosen intentionally on the basis of presence or absence of such items as cooperatives, irrigation schemes, specialty crops, nonagricultural activities, and other locational factors. Data were collected by trained interviewers. Many villages were resurveyed after about a decade. As in the ethnographic approach, insights were to be derived from a comparison of data across space and over time. A comprehensive scheme to gather, process, and analyze all these studies was implemented recently by the Institute of Development Studies in Sussex (Moore et al. 1976).

These AERC village studies were often criticized for an absence of a statistical framework of choice for the villages, which limited the generality and statistical analysis of its results; but given their purpose, this criticism is probably somewhat unjustified. Another criticism was that the process of gathering and analyzing the data was somewhat routine, which often was done by junior researchers without high level analytical skills. Only a few AERCs continue these village studies, and those who do most often carry out resurveys rather than initiate new ones.

On-farm Testing and Demonstration of Agricultural Research Results

Most coordinated crop improvement projects of the Indian Council of Agricultural Research (ICAR), the All India Coordinated Research Project for Dryland Agriculture (AICRPDA), and the All India Agronomic Experiment Scheme have found it necessary to test and demonstrate their findings at the farmer's field level. This is done by systematic minikit variety trials all over India in the case of crop improvement projects, by demonstration programs, and, more recently, by pilot and operational research projects, such as the one sponsored jointly by AICRPDA and the Drought Prone Area Program (DPAP) of the Ministry of Agriculture. The pilot projects aim at testing and demonstrating packages of new crop, land, and irrigation technologies in groups of villages, biological-technical scientists interacting closely with the farmers. In the AICRPDA/DPAP projects, a team of economists works with the technical and biological scientists to evaluate the economics of the prospective technologies. In addition to the input-output data from on-farm demonstrations and evaluations, the economists also undertake studies of traditional villages outside the schemes; these are used as comparisons with the demonstration villages. Adoption studies are also undertaken. Social scientists are not involved in the minikit and other demonstration programs. Most of these efforts focus on testing and demonstration of technologies developed at research stations rather than on developing on the farm something "from the bottom up," although there is of course a considerable feedback of ideas from farmers to researchers.

Initial Approach of ICRISAT Village-Level Studies

ICRISAT's VLS were designed initially by the Economics Program primarily for its own objectives, but in close consultation with technical scientists. An attempt was made to combine the most desirable features of several of the approaches discussed in the preceding section. The following approach was therefore used:

1. Two "typical" villages having no prior history of special programs were selected in each of three agroclimatic regions of semi-arid tropical India. Three areas were included to allow comparison *across* agroclimatic zones. Two villages were chosen in each region so that, at a later stage, one could be used for the development and testing phase of technology (to be discussed later) while the other served as a control village. The villages were chosen so as to represent the typical features of their zones (Jodha, Asokan, and Ryan 1977).
2. Within each village a sample of 30 cultivators in three size classes and ten landless laborers were randomly selected as a *panel* to be monitored over a number of years. Such a large within-village sample was judged necessary to statistically test hypotheses within and between regions, villages, and socioeconomic groups within villages.
3. An investigator with a university education in agricultural economics, coming from a rural background and speaking the local language, was stationed in May 1975 in each village to interview the panel households every 3 to 4 weeks and to undertake a number of agrobiological investigations. He was also to act informally as a *participant observer*. The investigators were directly supervised by senior staff of the Economics Program who initially spent considerable time in the villages.
4. Data on agricultural operations were collected on a *plot basis* and included labor inputs and time allocation of each household member and bullock pair, economic transactions and incomes (agricultural and nonagricultural) of each household,

farm structure, and capital endowment of each household.

5. During the 1976–77 crop year, special teams of medical doctors and home science graduates visited each village four times to collect *nutrition and health* data on each household member.
6. From 1978 onwards, anthropological data collection was intensified. (For a detailed description of the data gathered see Binswanger and Jodha 1978). From the socioeconomic point of view, the VLS are broader in scope than each of the types of inquiries mentioned above, except for studies adopting the ethnographic approach. The data are collected so as to allow *statistical* analysis, and the panel approach allows easy *resurvey capability*, as well as the administration of *special-purpose surveys*, which become necessary from time to time.

All staff members doing research that involves household-to-household variation are encouraged to do their work in the context of the VLS so as to economize on background data collection and to subject the data to analysis from many points of view. This has led to close interaction within the socioeconomics program, and to a greater accumulation of complementary results on the same areas and households. This has provided more than each individual project could have provided if carried out by itself.

During the first 2 years, the VLS was used by other ICRISAT programs for farm-level observations of existing techniques and problems such as the prevalence of pests, diseases, and weeds, and the study of germination problems in chickpea (Jodha, Asokan, and Ryan 1977). Before turning to the later development of the studies—with much closer involvement of technical scientists in actual research in the villages—we briefly summarize the objectives and scope of the socioeconomic observation phase just described.

Objectives, Scope, and Results of Socioeconomic Observations

The socioeconomic observation phase, which is continuing, has two main objectives: (1) observation and documentation of existing practices

to help in the assessment of research priorities and potential technology and (2) generation of a data bank for a broad range of socioeconomic inquiries.

The first objective—observation and documentation of existing practices—is the most important to ICRISAT's Economics Program in terms of the overall ICRISAT objectives. Sufficiently detailed data at the farm level—with attention to technological factors—simply did not exist for the semi-arid tropics of India in 1975. The following studies were geared towards this objective and drew extensively on village-level study data.

1. "Resource base as a determinant of cropping patterns," by N. S. Jodha (1977), documents the important effects of resource endowments on cropping patterns and practices. In particular, it analyzes the importance and complexity of intercropping in poor soil-climate environments and on small farms. This study has helped justify more intensive intercropping research at ICRISAT.
2. "Economic aspects of weed control in semi-arid tropical areas of India," by H. P. Binswanger and S. V. R. Shetty (1977), documents the relatively high levels of human and animal techniques of weed control in these environments. Together with budget studies, which demonstrated that chemical weed control would be much more expensive than existing weed control practices and also highly labor displacing, these findings have led ICRISAT to deemphasize chemical weed control in the Indian part of its research program.
3. "Factor proportions, factor market access, and the development and transfer of technology," by J. G. Ryan and M. S. Rathore (1978), demonstrates that factor *endowments* differ widely on large farms and small farms but *factor use ratios* between small and large farms differ much less among the groups, although there is a large variation within the group. The closeness of the factor use ratios suggests that there would be little justification in India for developing separate technologies with basically different capital-labor ratios for small and large farms. Support for small farms must be

sought primarily via improvements in their access to modern inputs, credit, and extension.

4. "Risk attitudes of rural households in semi-arid tropical India," by H. P. Binswanger (1977), is based on a large special-purpose psychological experiment carried out with the panel households, supplemented by the general VLS background data. It demonstrates that risk attitudes differ little between small and large farmers in these six villages; nearly all of them are moderately risk averse. This suggests that not much can be gained by developing technologies with differential risk/return characteristics for small and large farmers. Emphasis has to be on relatively profitable and stable technologies for all farmers and support of small farmers via improved access to credit and inputs.
5. "Labor use and labor markets in semi-arid tropical villages of peninsular India," by J. G. Ryan, R. D. Ghodake, and R. Sarin (1979) looks at existing and potential labor and bullock-power bottlenecks in the study areas by comparing the existing labor use and availability patterns with those experienced in the research watersheds at ICRISAT Center. The study suggests that important new labor peaks could arise at harvest time if improved technology were to be introduced. It also documents the overriding importance of female labor in SAT agriculture and the extraordinary handicaps faced by female workers in rural labor markets compared with male workers.

The nutrition data are still being analyzed to further improve our understanding of human nutritional deficiencies and thus to help us determine what type of nutritional objectives — if any — it makes sense to include in our plant breeding programs.

The cultivation data are now being intensively analyzed to provide a comprehensive set of input-output coefficients for traditional technology. These will be used along with comparable input-output coefficients from research station experiments at ICRISAT and elsewhere, in benefit-cost analysis of potential technology. This is a particularly good example of how VLS data are used in conjunction with data from other sources. Activity analysis mod-

els are presently being constructed to provide a comprehensive framework for technology assessment.

The second objective of the socioeconomic phase — generation of a data bank for a broad range of socioeconomic inquiries — goes beyond technology assessment. It includes the collection of information that will help in formulating general socioeconomic policy in the SAT. Household data are an important source of such knowledge and the VLS are our primary source. Studies toward this objective based on the VLS data include:

1. "Role of credit in farmers' adjustment against risk in arid and semi-arid tropical areas of India" (1978) and "Effectiveness of farmers' adjustment to risk" (1977), both by N. S. Jodha. They demonstrate the high cost and relative ineffectiveness of the farmers' own measures to reduce the risk of farming in these areas of India and to adjust to drought and scarcity conditions. Together with the work on risk attitudes, they suggest that the high risk levels of SAT farming may lead to a general underinvestment of resources by farmers of the SAT relative to the socially optimum level. Furthermore, it appears that the official credit institutions are thus far ill-equipped to reduce the exposure of Indian farmers to these risks because they cannot or do not provide consumption loans to drought-affected farmers. On the other hand, public relief employment appears to be remarkably effective in meeting its objective; strengthening of that effort appears well worthwhile.
2. "Some aspects of agricultural tenancy in semi-arid tropical parts of India," by N. S. Jodha (1979). The author uses the close involvement of investigators in the villages to gather detailed tenancy data of an unusual quality and depth. He finds that renting of land by large farmers from other large farmers and from small farmers has become an important feature of the SAT. While resource adjustments are the most important reason for tenancy, there are many other complex reasons as well. The idea of the small and highly exploited tenant clearly needs to be revised, along with the notion that tenancy laws can be

enacted that will primarily benefit the small-farmer group. The situation is much more complex than believed, and well-intended legislative efforts can lead to unintended results. The same data are now being used by a Ph.D. student from the Indian Statistical Institute for a further detailed inquiry into all aspects of tenancy.

3. A Ph.D. dissertation by M. S. Rathore, a scholar from Himachal Pradesh University. He has used the VLS data to reinvestigate all aspects of the farm size-productivity controversy. He finds no uniform productivity advantage in small farms; in some areas small farms have higher total output per hectare and in others they appear to be less productive than the large ones. But he confirms that large and small farms pursue very different strategies to achieve their production levels. Large farms rely more on purchased inputs and have modest labor inputs, while small farms compensate for their low borrowing capacity primarily by more intensive and apparently more organized labor inputs.

In the coming year, the VLS data will be used by ICRISAT staff for an econometric analysis of seasonal-labor supply-and-demand behavior and for analysis of the relative access of small and large farmers to credit, to modern input markets, and to output markets; of the distribution of income and its sources in the study areas; and of the determinants of fertilizer use on semi-arid tropical crops. Other special-purpose inquiries may be initiated from time to time.

The richness of the data is not exhausted by these inquiries. We encourage ICRISAT staff and outsiders to make use of it. Our capability to provide the data to outside researchers has been hampered by the enormous problems of computerizing a data base of this size. We are currently reducing the amount of data processed by computer in order to speed up this operation, and the software to handle it has also matured. We were probably overambitious in the scope of computerization we planned. As a result, there has been a predictable slowdown in the operation. However, we feel that in the long run computerization of a large portion of the data is essential for easy access by researchers inside and outside of ICRISAT.

The Research and Adaptation Phase

Interaction with technical and biological scientists was sought from the beginning of the VLS. During the first 3 years, the socioeconomic staff reported their observations by means of informal tour reports. More importantly, the economic investigators were trained by the ICRISAT programs concerned to make systematic observations of disease and pest incidence, nodulation of legume crops, small germination experiments in chickpea, etc., and they were visited in the villages by the biological scientists. From 1977-78 onwards, one important component of the intercropping entomology research was transferred to farmers' fields, where it is carried out according to normal experimental procedures with replications, etc; because such research needs to be done on large plots in an environment in which pests are not disturbed to the extent they are at an experiment station. Furthermore, uniformity of soil is not as important in entomology experiments as in some other research projects. We anticipate that other research programs will find it useful from time to time to escape the land pressure and special conditions of the experiment station and do research in village conditions.

In 1977-78, the Farming Systems Research Program of ICRISAT started an experiment to assess the potential yield effects of herbicides over and above the yields achieved by the farmer's traditional weed control methods. The treatments contained weed-free plots, plots where farmers used their usual methods, and plots that were partially or totally treated with herbicides. The particular advantage of such research in farmers' fields is that one is sure of getting the "traditional" treatment right and does not set up control treatments that underestimate or overestimate the farmer's capacities. During the 2 years of the experiment, no yield effects of herbicides over and above the farmer's treatments could be statistically demonstrated (Davis 1979).

Starting in 1977-78, the Farming Systems Research Program also initiated studies of traditional tank irrigation systems in two villages. These involved the measurement of the actual flows of water, including ground water levels in

the irrigated command areas of these tanks, to determine the water use efficiency of the systems. It became necessary at that stage to hire technical staff in these villages to make the daily measurements.

At about the same time, sufficient results on the watershed-based soil and water management systems of the ICRISAT Farming Systems Research Program became available to narrow down the technical possibilities enough to make it worthwhile to pursue further research under local conditions at the level of the farmer's field. This had to be a collaborative effort between farmers, technical scientists, economists, and the anthropologist, because it involved technical, economic, and social problems of group action or collaboration among the farmers of a watershed. Research on group action problems of watershed-based soil and water management systems cannot be done at a research station, and their solution is a precondition for successful implementation of the concept.

Furthermore, technical adaptation of the concept to local soil and climate conditions made it imperative to associate the project with AICRPDA, with its research stations in Hayatnagar, Sholapur, and Akola as well as the coordinating cell in Hyderabad.² Other institutions collaborating with us are Andhra Pradesh Agricultural University, Punjabrao Krishi Vidyapeeth, Akola, Mahatma Phule Krishi Vidyalaya, Rahuri in Maharashtra, and the Central Soil and Water Conservation Research and Training Institute in Dehra Dun. The broad geographical experience of these institutions is necessary in defining the technical treatments at each of the three locations. Particularly in the definition of agronomic treatments, we rely heavily on the experience of the local centers of the AICRPDA, which specify the recommended varieties, fertilizer levels, etc.

During the 1978-79 crop season, an area between 2.5 and 4.0 ha in one village in each of the three agroclimatic regions was planted to a series of replicated trials in which the major purpose was to test the effects of improved land management systems on dryland cropping systems, which are typical or potentially impor-

tant for the farmers of the areas. In the current year, in two of the three villages, full watershed land treatments have been implemented on areas of close to 20 ha overall. In a third village, it was difficult to gain the cooperation of all farmers on the experimental watersheds during the current year, but isolated treatments have been implemented on the fields of two farmers as an initial step. Agronomic experiments continue. To carry out this additional experimental load, one agronomic/technical staff member at the Technical Assistant level has been stationed in the three villages on a permanent basis; he is backed by visits of the concerned scientists.

Unlike the demonstration programs and pilot projects discussed in the first section, the goal of these studies is not demonstration of a fully or partially developed technological and institutional package of watershed-based soil and water management treatments; instead, the focus is on *adaptation of such a concept to the local agroclimatological and sociocultural conditions and feedback to researchers from the grassroots level*. It is well understood by all involved, including the farmers, that this process will be difficult. However, the village locus is the proper experimental setting for such adaptive research. Only there will the real problems have an opportunity to express themselves and thus lead quickly to the necessary changes in the technological and institutional options. The choice of the villages of the VLS makes profitability assessment of watershed treatments relatively easy, since the data on the panel households provides a "comparison treatment" both before and in every given year of the study. Furthermore, one village in each region is left unaffected, to serve as a control for assessing hidden impacts of a substantial research effort in the other villages. Thus we have comparisons both "before and after" and "with and without."

Should this research effort lead to successful development of adapted technology options, the villages would serve for demonstration purposes, but national programs would then have to move towards a more comprehensive demonstration and implementation phase. ICRISAT's mandate does not include extension.

Conclusions

The ICRISAT Village-Level Studies have pro-

2. These centers had assisted us from the start of the VLS, especially in the choice of villages.

vided a rich variety of opportunities for research.

For socioeconomic research, the semipermanent nature of the studies provides a unique setting for all inquiry that involves household-to-household and agroclimatic variation. By combining features of ethnographic research, special-purpose surveys, farm management studies, village studies, and on-farm biological/technical experimentation, the VLS provide flexibility in data collection and a rich data bank. They perform the same function for the socioeconomic researcher that the experiment station or laboratory performs for the technical/biological scientist. They provide a *locus for research*, or a tool to be used in a variety of studies. By channeling the analytical capability of a number of socioeconomic researchers inside and outside of ICRISAT on the same data base, they produce complementaries which add up to more than the simple sum of the individual results and insights.³

For the technical/biological researcher, the studies serve as an extension of the experiment station outside its physical confines, to be used in a variety of ways as dictated by the changing needs of individual researchers or programs. Research can be carried out in the villages under actual farm conditions and/or when land requirements exceed the land resources available at the research station.

From the point of view of *technology development and adaptation*, the studies have two main functions: first, they serve as the most important data source (but not the only one) for specific studies assessing research priorities and prospective technology; second, they provide a locus for a multidisciplinary effort on what may be the most difficult research problem of the semi-arid tropics: generating improved soil-, crop-, and water-management techniques that are adaptable to different agroclimatic, economic, and sociocultural environments. We believe that the village is the best environment for this effort. It involves farmers and scientists from the national program, as

3. One of the major problems of much survey research is that it appears to be easier to collect data than analyze them. Large bodies of data are therefore often unexploited. The VLS have been relatively successful in achieving a better relation between analytical and data-gathering effort.

well as from ICRISAT, and we hope that it will continue to be successful. The VLS are our approach to the philosophy of agricultural research from the "bottom up" and development emphasized by Newman, Ouedraogo, and Norman (1979), Chambers (1979), and others.

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