THE INDIAN JOURNAL OF AGRICULTURAL ECONOMICS

(Organ of the Indian Society of Agricultural Economics)

Vol. VI	MARCH 1951	No. 1

CONFERENCE NUMBER

PROCEEDINGS

of the

ELEVENTH CONFERENCE

held at Lucknow, December, 1950

SUBJECTS

1. Administrative Machinery for the Economic Reconstruction of Rural Areas.
2. Fixation of Agricultural Prices in Theory and Practice.
3. Effects of Industrialisation on Rural Life and Rural Economy.

Rs. 6-8-0

THE INDIAN SOCIETY OF AGRICULTURAL ECONOMICS
BOMBAY

AIMS AND OBJECTS

To promote the investigation, study and improvement of the Economic and Social conditions of agriculture and rural life through :—

(a) periodical conferences for the discussion of problems ;

(b) the publication of papers, separately or collectively ; or in a periodical which may be issued under the auspices of the Society ;

(c) co-operation with other institutions having similar objects, such as the International Conference of Agricultural Economists and the Indian Economic Association, etc.

ACKNOWLEDGMENT

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I. Administrative Machinery for the Economic Reconstruction of Rural Areas.

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III. Effects of Industrialisation on Rural Life and Rural Economy

PRESIDENTIAL ADDRESS

BY

Dr. T. G. SHIRNAME

RESEARCH METHODS IN AGRICULTURAL ECONOMICS

The Eleventh Conference of

The Indian Society of Agricultural Economics

LUCKNOW

December 1950

My plea for selecting this subject is simple, though I am aware that it would not satisfy many who had, at least by way of convention, expected to hear a speech dealing with some of the important aspects of rural economy of the country. It seems to be the convention to expect the Presidential address to deal with the most burning topic of the day or to take an overall review of the problems and indicate achievements and work still required to be done. It is also possible that quite a few might expect me to deal with current problems like Grow More Food, Cotton and Jute or with the general food situation from the point of view of my "inner knowledge" having regard to my official position. If such are the expectations, I am afraid, I am going to be a disappointment. Perhaps the most important feature of a Presidential Address is that the President is not called upon to speak on any particular subject. It is, in a way, a good convention in that it gives the President of the Conference a freedom of choice in selecting his own subject. We have had till now ten annual conferences and the ten scholarly Presidential Addresses in the past have covered most, if not all, of the various socio-economic problems of Indian agriculture, including the current topics of wide and vital interest like food, mechanisation of agriculture and improvements in land systems. These scholarly speeches have proved to be of utmost value in focussing the attention of Governments, public leaders, universities and others on the immediate need for study and action on the various social and economic aspects of our farms and the farmers. The great and immediate importance of the subject has now been universally recognised in India. Prof. A. W. Ashby's visit to this country during the last session of our Conference and his report on what he saw in this country have also emphasised the urgent need for exhaustive study of the subject.

These developments have resulted in an increase in investigation and study of the socio-economic problems of our rural areas—the most important object of the Indian Society of Agricultural Economics. Universities, colleges, individuals and even few Government institutions are taking more active interest in the subject. The number of investigators and research workers, therefore, is increasing. I, therefore, consider that it is time that these workers and their work should receive consideration. I have had the privilege of being closely associated and actually working in the study or investigation of one or the other aspect of agricultural economics during the past twenty-six years and I have reasons to believe that the importance of a really dependable agricultural economic investigator and the complexity and implications of the

problems entrusted to him have not yet been adequately appreciated by those in charge of authority providing funds or—to say bluntly—administrators. The tendency for emphasis on quick results with the minimum expenditure of time and money has been increasing, more especially during the recent past, affecting adversely even fundamental research in abstract sciences like physics and chemistry. Unlike all other sciences, including physics and chemistry, an agricultural economic investigator has to deal more with human and moving factor—a factor which is perhaps the one most exploited by all and which, in consequence, continues to be most disorganised and full of suspicion—and at least to that extent, the work of an agricultural economic investigator is more difficult and is of a more complex nature than in other sciences. The urge for quick results—nay, reports—seems to be all pervading and the investigator has got himself inevitably involved in it. It is difficult to blame him. His career and boss demand quick results and as many papers or reports during the minimum period of time as possible.

Action for improvements is in the hands of administrators and this should be so and would continue to be so. But a question arises as to whether this action is based on thorough and dependable investigation or research or on the basis of the **ad hoc** enquiries or on the basis of reports compiled somehow during a stipulated period and amount of time and money. It is therefore of utmost importance that those in charge of authority and administration should know the scope and method of agricultural economic research. The research administrators and investigators, on the other hand, should know their own limitations and the scope and limitations of the fields of their research.

This, in brief, is the plea for the subject of my address. I realise that the world is moving fast—speed is the slogan—too fast to keep pace with the natural and acquired habits of human mind and body. This would be evident from a few hours' stay in a place like New York or Chicago or Washington, places of perhaps the largest number of nervous breakdowns in the world, but everybody would agree that in the newly acquired freedom, we definitely need solidarity and not speed and not "to do it somehow and quickly", merely because "I am in a hurry and therefore every one else also must hurry".

Coming now to the subject of my address, it is well known that the method of research in any science consists, in general, of two aspects: its techniques or tools and its methods of collecting and handling the data and the technique. The first aspect includes such things as the selection of the problem, its preliminary analysis and definitions of measurements and enumeration, and the second consists of the consi-

deration of the importance of the qualifications and of equipment of the research and field workers, the accumulation of facts or data, the classification of these facts and the discovery of relationships or lack of relationships between them.

The Selection of Problem

It is not difficult to select an ideal research project, but ideals have, of necessity, to be limited by practical considerations, especially in agricultural economic research which depends very largely for its success on the co-operation of the rural community which is proverbially conservative. Before the problem is selected, therefore, the first essential is to determine the extent of co-operation likely to be obtained from the farming area proposed to be studied. It is usually better to start investigations on a subject in which the farmers would be immediately interested. Once their interest is secured, it becomes less difficult to take up other projects. The method of determining the possible co-operation will depend upon the progressiveness of the rural community, but possibly the method of approaching the farmers through local leaders is the best. Local meetings may be sometimes useful but these are not always safe. An obstinate person—and there are always some in every community—may carry with him the whole group of farmers thus leaving no chance for any kind of work. Professor Andrew Boss says, "The farmer will listen to the sound of money quicker than to anything else, and it is for that reason that we usually approach him from the business standpoint. Ask him if he wants to make one hundred dollars, and he will be immediately interested; but ask him if he wants to buy a better cow, and he will say, 'No, I guess the old one will do.' " *

Another limiting factor is the quality of investigators and the extent of funds available. In a country like India where the actual field research is still in its infancy, it is desirable to select projects which give results in a relatively shorter time, of immediate interest to the farmers or to those concerned with agricultural policy. It frequently happens that investigators in their first enthusiasm start with a number of projects or make the scope of the selected one so wide that a great mass of data, which would otherwise have been useful, remains unutilised. It is, therefore, of utmost importance to make the project definite and clear-cut and keep its scope within manageable bounds.

Preliminary Analysis

After the research project has been so selected, the next thing to do is to get together all the possible information and data from secondary

* Journal of Farm Economics, Vol. III, No. 1, Jan. 1921, P. 31.

sources. No beginning of the actual field work should be made before making a preliminary survey of the subject of investigation to discover all the related literature and get all data that could be obtained without actually going into the field or universe to be studied. The next step will be to study this related literature critically and find out the methods of collection and analysis, the units, measures and concepts and the general deductive conclusions and the conditions under which the different studies were made.

But something more is necessary in order to define more correctly the scope of the project of study and to decide upon the method of research. Isolated facts collected at random, however numerous, do not constitute science and in order to delimit the field and fix up methods, one has to adopt some provisional hypothesis which will provide a systematic guide for collecting only the right type of material. The accuracy of the first step in social analysis depends on the power of determining salient features and specific characteristics among individuals in any aggregate. It is one of the peculiarities of social science research that practically everything must be anticipated in advance, all possible sources of error and difficulties detected and provided for, and general conclusions estimated.

Before, therefore, we can use inductive methods, we must make some analysis of the phenomena to be observed, and it is possible that the best form of first analysis is that of a set of questions rather than a list of statements. These questions will have reference to what we expect to find, but they do not themselves suggest that what we expect to find is there; they will ask whether it is there. These questions may be framed out of "common sense" or by preliminary analysis. Having asked the questions on the facts, we get the fact in the form of reply and there is then not even apparent conflict between postulate and facts. The answer is in the form of yes, or no, or partially yes, and partly an indication of something else.

One peculiar characteristic of social observation may be mentioned. More or less each man takes what he himself has seen and ascertained for a sample of all that is seeable and ascertainable. As Carlyle says, "Each man expands his own hand-breadth of observation to the limits of the general whole". This is one of the difficulties of studying economic and social organisation which may embody qualities which are not present in the mind of the observer. The observer must have a catholic and comprehensive mind—the power of seeing many qualities and of appreciating that they have values for individuals and groups, though they may have little or none for him. The limitations of the

observer, attempting to study communities and conditions which are strange to him, are therefore obvious.

It is, therefore, unnecessary to exaggerate the importance of this comprehensive preliminary work except to say that a great part of success of workers in agricultural economics is dependent on it. The justification of emphasis on preliminary analysis—observation, information from secondary sources and mental analysis, especially the first and the last, is perhaps the practical one of saving time and energy. There is, of course, danger of inadequate or ill-minded analysis of logical character. It has been the experience of many, if not all, that a mass of material was collected without giving adequate attention to preliminary analysis and that it was never used because of either want of time or help or that the data became out of date as it could not be used in time.

Measurements and Definitions

"In collecting data for scientific thinking the fundamental virtue is accuracy and it is impossible to exaggerate its importance. Science begins with measurements with which we include, of course, every method of precise registration".* Like other sciences, research in agricultural economics affecting individual farms and farm families begins with enumeration and measurement. But the degree of precision is limited by that of the farmer or the businessman who co-operates to supply information. The precision may also depend on the precision in basic agricultural sciences in so far as economics takes **conclusions** from them.

It is perhaps natural to confuse enumeration with measurement and to suppose that facts are known with precision because they have been enumerated, or may be known with precision because it is possible to count them. But enumeration may not mean more than partial measurement, and it may not in fact be more than counting.

Measurement is a scientific procedure only when equal numbers represent absolutely identical values. A common unit is always necessary for measurement. When we cannot measure, we enumerate. Enumeration is applicable to all facts which have in common a definite characteristic which can be made use of for counting them.

But what is to be measured and enumerated is the next question and for this it is absolutely essential to define the different units, terms and measures to be used most accurately and in most unmistakable terms. Perhaps the first thing to be borne in mind, before a unit or term or measure is selected, is to determine whether it can be precisely ascertain-

* Thomson, J. A.—Introduction to Science, p. 65.

ed. All definitions must be worked out in minute detail so as to cover all imaginable meanings and difficulties. In some cases, the definitions must be tried out in the field before they could be finally accepted. All the measurements and definitions so finalised must be clearly and separately mentioned in the final report of the research project to facilitate examination of the report by any person, at any time, at any place and in any country of the world.

Methods of Collecting Data

All methods of agricultural economic research followed in different countries and known under different names (**e.g.** survey method, cost accounting method, etc. etc.) can be brought under one or more of the following three divisions:

I. Secondary or Historical Method.

II. Primary or Field Work Method.

III. Mailed Questionnaire Method.

One method may contribute more to the solution of a given problem than the other. But all may have to be used for a complete solution of the problem.

I. Secondary or Historical Method

The method of history is essentially a method of studying past events. It consists of processes employed in the search for historical facts from evidence prepared by previous observers. The study of history is based on document. "The document is the starting point of the historian, the fact his goal".*

The method serves two purposes in agricultural economics. In the first place, it helps to supplement information and facts obtained first-hand either by the field work method or the mailed questionnaire method, and secondly, it serves as an independent procedure of research in so far as in the study of economic forces much is gained by tracing their operations through a considerable period of time. "Economic forces are not easily measured and they are so numerous, of such varying strength, and so often operate in opposite directions that at any given moment it is difficult to make an estimate of the future resultant of these forces, unless the changes wrought by them in the past can be resorted to as a basis of judgment".* "It is only by watching the process of growth and decay during a period of time, can we understand even the contemporary facts at whatever may be their stage of development, and only by such

* Fling, F. M.—The Writing of History (London, 1920).

* Taylor, H. C.—The Place of Economics in Agriculture, Education & Research, (Wisconsin Bulletin No. 16, 1911, p. 108).

comparision of the past and present processes can we get an insight into the means of change".** The importance of the continuation of the economic study is thus obvious. Possibly the most important use of the study of the economic history lies in the fact that it enables us to judge the present and predict the future in the light of past experience. The study may give results even for experimenting in economics.

The chief processes of the historical methods will be, the determination of the facts of change, the tracing of the process of change and the discovery of the causes of change. In order to determine, understand and explain the changes brought about in agriculture by economic, social and other forces, it becomes necessary to trace the history of sucessive changes of development of agricultural and rural social organisation. It has been long recognised that to trace and explain the processes underlying the structure and functions or the conditions of health and disease for a given piece of economic organisation, the use of historical method is imperative.

The source material required for such work has, of necessity, to be of an indirect and second-hand nature since past events cannot be observed in the present. It will be a matter of chance whether the source material exists or not and the investigator has to adopt his project to the existing source material. It has been, therefore, considered a point of sound scholarship to bring together all the evidence on a topic before a historical project is outlined in detail. It will be a lack of understanding of real conditions of scientific advance and waste of time, energy and expense if no advantage was taken of all the good work done in the past on the selected project. Compilation of a critical bibliography or a list of known or possible sources of information is therefore the first essential in starting the study on any project. After compiling the bibliography the next step should be the search for material. In the search for material, it is not unusual to find one thing leading to another in an unexpected manner. "To arrange in a rational and convenient manner the material is a very important part of the historical profession".*

Critical Examination of the Sources—Perhaps it is much easier to arrange and get information and facts from secondary sources, but it is certainly more difficult to evaluate them. The details of phases and conditions of human society are so manifold and there are so many ways of looking at the same thing, that there is a possibility of coming across with conflicting views and interpretations. The chief aim of criticism is to find out truth from untruth. There is always a natural tendency

** Webb, Mrs. Bee—"My Apprenticeship". (London, 1926, p. 246).

* Langlois & Seignobos—Introduction to the Study of History (London).

to accept as truth whatever is contained in a document or as a matter of that whatever has been published. This is "equivalent to assuming that no author ever lied or was deceived".* Accuracy is the first thing in any scientific work and the most important step in the use of historical method for research is the determination of facts. A fact is what actually took place. Sufficient evidence must be gathered to determine the possibility. After possibility has been recognised, the probability or certainty will have to be next examined for the establishment of **actual** facts. It may be taken as a rule that the condition of certainty is the existence of at least two independent witnesses of the same detailed fact. If their affirmations agree then the thing may be taken as a fact unless the witnesses are self-deceived.

The **external** value of a source is determined by the consideration of the genuineness of its author and the circumstances of time and place under which the source was compiled. A document about which there is no satisfactory evidence as regards its author, time and place, is risky for use and usually discarded in historical research. The good faith, reliability, position, status and general views of the author and his ability to get at the facts must be studied to determine his genuineness. It may happen that the assertions contained in the document are not related to the author's own observations and in such cases the truth and accuracy of the source of the author will have to be determined. Mere statements of opinions without substantive evidence will have to be used with great reserve after considering the position and views of the author. In the case of newspapers, journals, and political pamphlets where there is no question of authorship the general policy of the issuing institutions or persons must be given proper weight. In using reports on prices, production, census, etc. issued by public authorities, it is very essential to evaluate the methods used in collection and compiling data. The details or limitations are sometimes explained in the introductory remarks or notes but it is not unusual to find investigators using tables on prices, production, etc., without taking adequate care to look into the deficiencies or limitations of such tables. In such statistics, which are issued periodically, sometimes a change is observed in the mode or circumstances of their collection and presentation. Under such conditions, some adjustments are essential before a study of periodic variations is attempted.

Internal criticism is an analytical criticism and its chief function is to determine accurate interpretation warranted by the evidence contained in the document. This interpretative criticism consists of two parts, the understanding of literal meaning and establishment of true or real intention. In cases where documents from remote past have to be

* Langlois & Seignobos—Introduction to the Study of History (London).

used—as for instance in some of the village surveys—a knowledge of philology or of the grammar, vocabulary and niceties of ancient language would be helpful. The other part of interpretative criticism will consist of the examination of the good faith and accuracy of the author.

These are some of the important points which must be taken into account before a research project is attempted. By far the largest number of agricultural economic investigations conducted in the past in this country are based on facts recorded in the past by others. There is a general tendency, especially on the part of young investigators, to accept as true whatever has been recorded or published by authors in the past. There is, therefore, not the least doubt that these suggestions would be of considerable assistance to such investigators.

II. Primary or Field Work Method

The social universe is so large that it will be practically impossible to cover the whole field even if an army of workers is employed, except when the State is prepared to bear the expenses of a universal survey as in decennial census. The field has, therefore, to be limited and there are two ways in which this can be done. One way consists of a conscious selection of a few typical or representative cases and studying them intensively. The typical cases recorded may include an individual, a group or an institution. This may be called as the method of studying individual or the **case method.** The other way is to make random choice of a group supposed to be representative of the universe under consideration and studying extensively the whole group. This is the method of studying groups or the **method of sampling** the universe.

Before proceeding to discuss these two methods, it may be mentioned that it is very easy, in theory at least, to find out absolutely typical or representative cases or samples, but the subject of agricultural economic research presents peculiar difficulties in selecting ideal cases or representative samples. Research, in a great part of agricultural economics, like farm fanagement, marketing efficiency and rural standard of living studies, has, of necessity, to go into the individual financial affairs and few people are prepared to disclose their private affairs. This kind of prejudice is universal, but it is particularly more pronounced in ignorant, illiterate and unorganised communities, where investigators are, many times, taken as public informers and the State an exactor of taxes. Ideals have, therefore, of necessity, to be limited by practical considerations, and investigators have to select only from amongst those who are persuaded with some efforts to co-operate. It is very likely that only the more intelligent will be prepared to co-operate in the first instance

and conclusions obtained from such studies may be vitiated. Perhaps those who have a fairly large, stable and successful business may not care to co-operate. It may happen that the more needy or the less successful will co-operate. Sometimes it becomes possible to get farmers from the lower range through the influence of a local leader. Quite frequently, the agricultural economist has to work out the extent to which the co-operators would approach the ideal or theoretical representatives. Although the field of choice thus becomes limited for studies concerned with financial affairs of individuals, it is quite possible, under certain conditions, to select a fairly representative case or sample for non-financial investigations.

(1) **The Case Method**—This method consists of selecting a few typical cases, representative of a fairly large group or class of a community of which they form a part. Representative, as defined by Marshall, means, "one which has had a fairly long life, and fair success, which is managed with normal ability; and which has normal access to the economies, external and internal, which belongs to that aggregate volume of production"*. The case may be an individual, an institution, a community or any group considered as a unit for study. The method lays emphasis on the study of individual behaviour with a view to the formulation of hypothesis in regard to the total social setting. In selecting the normal, representative, average or typical cases, the cases at the two extremes of the average are usually left out for consideration. Under such circumstances, the farmers at the lowest extreme of the average who require perhaps the largest amount of guidance at the hands of agricultural economists are likely to be left out, while those at the upper extreme who may disclose some of the secrets of their success may also be overlooked. To avoid this, it is always better to select typical cases from each of the fairly uniform groups of the society intended for observation.

In order to get some correct knowledge of uniform groups and typical cases, a broad preliminary analysis may have to be done in the first instance. The first stage of such preliminary survey will be the determination of type of farming areas. To ascertain a homogeneous type of farming area, the uniformity with regard to natural conditions like soil, topography, rainfall, climate and irrigation facilities will have to be determined first. The uniformity in respect of production practices—crop and livestock enterprises—will have to be found out next. This should give a fairly good idea of type of farming areas. If such an area happens to be large, an attempt will have to be made to ascertain some unit constituting a single village or a small group of villages representative of the typical farming area.

* Marshall, A.—Principles of Economics (Eighth Edition, 1925, p. 317).

Having decided on a typical village or a group of villages, the next stage will be the arrangement of farms within the typical village or villages into frequencies. The usual method is to arrange the farms into frequency groups by size. But a farm may be typical in size but may not be so in productive capacity or the number of working members in the farm family or the soil type or the number of fragments of lands which make up the farm. If size be taken as the sole criterion of measurement of average success, then it is an easy matter to get the farms into frequencies and to proceed to select cases from the different size-groups. But as it is, size is not the only factor determining the type. Besides, much depends on how one arranges the frequencies. The different groups can easily be changed by adopting different class intervals for frequency determination and too much is thus left on the judgment of the investigator. After arranging the farms into different size-groups, the better way, therefore, is to find out the average soil quality in each group in terms of **anna valuation.** This determination of average soil quality may not be necessary in tracts where soils are of fairly uniform quality, but in a broken tract like the Bombay Deccan where soil varies, many times, from field to field, it becomes essential. With the determination of different size groups of farms, with the average soil quality evaluation for each group, the next step should be to find out the average number of fragments per farm in each group. The further procedure will be to ascertain the average production organisation, which would include such things as the percentage area under different crops, proportion of irrigated area and the number of working members per farm family.

Most of this preliminary analysis could be done with the help of village official records in temporarily settled areas. The determination of typical farms in this manner appears more reasonable and it is better to select for study a few cases typical of each group instead of selecting a few from the mode. In this way, the lowest, the average and the best could be studied at the same time and compared.

This should be usually the method in selecting farms for cost or financial accounting studies, especially when research in agricultural economics is in its infancy. In such studies, the farms are under direct observation for a period of time and as such the investigations are records of actual happenings.

In all such cases, however, it may be emphasised that the extended application of such research may be limited, if the persons who are being studied are conscious that they are under observation. Another effect of continuous observation of cases is that the very fact that they are being observed may lead to stimulus and to more efficiency or more

application. The observation may also stimulate plus contact with external ideas or some suggestions may lead to slight variations which may affect the results. In a continuous record plan extending over a year or more, a farm which was representative at the commencement of the study may not remain so at the end of the year. Statistical generalisations will have, therefore, to be made with considerable caution, even if all possible precautions have been taken to select only the representative cases.

(2) **The Method of Sampling**—For a fairly accurate statistical generalisation, the number of cases will have to be increased substantially. The greater the number of cases the smaller the error of observation in statistical analysis. When the number of cases is large, it does not become practicable to study them all intensively, chiefly because of the time and expense involved. An extensive method of study in which each case is visited once or twice has to be adopted. The increase in the number of individuals representing the universe can be obtained in two ways. One is to make a "conscious" selection by increasing the number of cases under each representative group, determined as discussed earlier. Any single investigation in farm management, marketing or some aspects of rural social living extending over the whole country or nation will be of little practical use, since conditions, both economic and natural, vary so much from one part of the country to another. The country has, therefore, to be divided into tracts where the economic, natural and also the social conditions would be fairly homogeneous.

The other way of selecting a large number of cases representative of the universe is what is called by statisticians as the "random" sampling. It has been mathematically approved by statisticians that it is not necessary to enumerate all the individual cases in a universe and that the characteristics of the whole universe can be studied very nearly correctly by studying fair-sized samples of the universe selected at random when each member of the sample will have the same chance of being included as any other.

The three conditions of simple or random sampling as given by Yule are as follows:

"(i) We assume that we are drawing from precisely the same record throughout the experiment .....

(ii) We assume not only that we are drawing from the same record throughout but that each of our cards at each drawing may be regarded quite strictly as drawn from the same record (or identically similar record) .....

(iii) We assume that the drawing of each card is entirely independent of that of any other ....."*

These three conditions can very rarely be fulfilled in any social investigation. The first condition of drawing from the same record throughout can be apparently satisfied when the universe selected is abolutely uniform. But the conditions in agriculture vary so greatly not only from tract to tract but also from farm to farm thtat we can never be sure that we are selecting samples from a universe which is absolutely uniform in all respects. Under the second condition, any individual selected may have all the characteristics that are found in the universe. Up to a certain extent, carefully selected individual cases may have certain broad essential elements in common with the universe, but they will not be identified with it in every respect. The third condition also cannot be fully satisfied, for farm enterprises are never independent of each other.

III. The Mailed Questionnaire Method

Sometimes, instead of sending a field worker into the field for collecting data, a questionnaire is either sent by post or given personally for reply to some selected persons in the field of enquiry. Government Commissions and Committees get a large part of their information by this method, the chief advantages of which are that it is easy to handle and that a large area can be covered at a relatively low expense.

As an independent method of collecting data for research in agricultural economics, it has a very limited scope, but as an instrument for tapping a supplementary source of information it has its own place in research methods. It can also be resorted to in conducting some general investigation of simpler problems like the land leasing systems, methods of wage payment, market customs and the like.

But there are many disadvantages which limit the scale of its utility. Perhaps the chief defect is that its success depends upon the co-operation of persons who usually do not feel interested in the work. A great bulk of farmers do not usually respond to any form of questionnaire. Even in a country of progressive farmers like the U.S.A., the average percentage of schedules or questionnaires returned does not go much beyond 10 per cent. And a good many of these returns are found useless because of mistakes or omissions of some questions. Another serious limitation is that those who send the replies are usually those who are more progressive and more successful than the average. This limitation may, to a certain extent, be avoided by including in the questionnaire

* Yule, G. U.—Theory of Statistics (1929, p. 349).

enquiries, the nature of which does not much depend on the representativeness of samples, as for instance, the methods of land leasing and wage payment.

Although the average response may be low, the percentage of returns will depend upon the nature of enquiry, the number and form of questions and the relation between farmers and research authorities. The enquiry must be simple enough to be answered by a few definite statements and as far as possible the questionnaire should be limited to questions which could be answered easily without prejudice, trouble of calculation or much expense of time and energy. All questions should be on one page and the questionnaire should bear a statement of object of enquiry in short, lucid and appealing terms. A stamped envelope accompanying the questionnaire for reply would be an advantage.

A cordial and satisfactory relation between research authorities and the co-operating farmers will help materially in getting back a greater proportion of the questionnaires. The method, however, has an extremely limited scope in our country where each village can boast of probably not more than half a dozen literate people usually not engaged in agriculture. A great many of these literate people are usually petty village officials who can be used—and many times with much success—for some general enquiries, provided enough influence is brought to bear upon them from district revenue officers, to whom they are subordinate.

The Research Worker, the Economic Recorder and his Equipment—the Schedule

A. The Research Worker

The progress of any science depends entirely on the character, integrity and scientific aptitude of its research workers. The importance of a real scientific worker in a new science like the economics of agriculture cannot be overstated. The three chief distinguishable qualities of a scientific worker as given out by Sir Michael Foster in his Presidential address to the British Association in 1899 are truthfulness, alertness and courage. To quote his own words, "In the first place, above all things, his nature must be one which vibrates in unison with that of which he is in search; the seeker after truth must himself be truthful, truthful with the truthfulness of nature; which is far more imperious, far more exacting than that which man sometimes calls truthfulness. In the second place, he must be alert of mind. Nature is ever making signs to us, she is even whispering to us the beginnings of her secrets; the scientific man must be ever on the watch, ready at once to lay hold of Nature's hint, however small, to listen to her whisper however low. In the third place, scientific enquiry, though it be pre-eminently an in-

tellectual effort, has need of the moral quality of courage—not so much the courage which helps a man to face sudden difficulty as the courage of steadfast endurance,"* to which may be added, the courage necessary for at least private, if not public, admission of temporary defeat. Writing about the scientific frame of mind, Karl Pearson in his Grammar of Science (1900, p. 6) says: "The scientific man has above all things to strive at self-elimination in his judgments, to provide an argument which is as true for each individual mind as his own. The classification of facts, the recognition of their sequence and relative significance is the function of science, and the habit of forming a judgment upon these facts unbiassed by personal feeling is characteristic of what may be termed the scientific frame of mind."

It is often said that a real scientific worker is born and that he cannot be created. Apart from the question of inherited qualities, the maxim of "occupation by birth"—one of the characteristics of Indian religious philosophy—has long lost its ground. None is born for a particular job. Science is no respecter of personalities. It is a matter of right training and opportunity. It is by conscientiously doing scintific work that one cultivates the scientific frame of mind. The research worker, therefore, grows with the growth of his researches. In the beginning of his research career, the investigator is very likely to commit mistakes but these will be stepping stones to success to many a conscentious worker. The science of economics of agriculture is so vast and the forces involved in any of its problems so numerous and the facts so scattered that there is every danger of committing blunders and sometimes drawing even wrong conclusions if the investigator is not properly trained. Before, therefore, the investigator begins his research he must have had a thorough training in the science and practice of agriculture, agricultural economics and political economy and also some reasonable experience of research under a more experienced worker. A knowledge of statistical method and logic backed up by cultivation of creative imagination and reason, will be of immense use in analysing and interpreting the research data.

B. The Economic Recorder

Primary research in a social problem begins with the collection of facts from the society which constitutes the field. In the case of agricultural economic research, the farming community constitutes the field or universe and much of the success of an investigator will depend on his relations with the farmer-co-operators and the way he gets out his information. In a well-organised and adequately financed research

* Thomson, Sir J. A.—Introduction to Science (p. 16).

programme, the Economic Analyst and the Economic Recorder may not—and usually are not—one and the same person. But in a newly organised section the economic analyst usually collects his own data. In any case the analyst should have some experience of recording. If the recorder has seen some processes or results of analysis of similar recording, in many cases he will be a better recorder.

The two conditions, as given by Mrs. Webb, for success in field work are: first, "the preparedness of the mind of the operator; the interviewer should be himself acquainted with all the data that can be obtained from the ordinary text-books and blue-books relating to the subject; especially important is a familiarity with technical terms and a correct use of them"; and second, "the person interviewed should be in possession of experience or knowledge unknown to the operator."*

The economic recorder or operator as called by Mrs. Webb, happens to be the chief support of an agricultural economic research programme, but not infrequently his position is overlooked. It is he who supplies the foundation and the quality of research depends very largely on his character, alertness and honesty. An unscrupulous worker may feel inclined to save much of his energy by putting down fictitious information without taking much bother of going into the actual field of research. This is likely to happen when the conditions and difficulties under which he is to collect his data are not adequately appraised and remedied for by the research director. Every detail which will aid the recorder in his work should, therefore, be very carefully considered.

A good recorder should have clear and exact conception of the data required, so that only correct and specified information would be collected. He should be easily approachable and never show a tinge of an air of superiority. It would be necessary for him to be brief in his statements and he should have a sympathetic attitude, agreeable manners and be always ready to accommodate under any inconvenience. It is not unusual to see the farmer giving irrelevant or inconsistent replies. One should never show boredom on such and similar occasions nor should any arguments come to pass. The real skill in such a case will be in sympathetic cross questioning. Probably the worst sin a recorder can commit is in the suggestion of answers or quantities. But an effort should be made towards stimulating the memory on the subject.

The field worker comes in direct contact with farmers and his attitude towards the farming community and farming, his mode of living and general behaviour, his general knowledge of the different branches of public agricultural activities and his willingness to help the farmers

* Webb, Mrs. B.—My Apprenticeship (Longmans, pp. 425-428).

in their difficulties will go a long way to get the necessary co-operation. In a continuous record plan, as in cost accounting, where he comes in closer contact with the co-operating farmer, he must, of necessity, be thoroughly "farm minded" and well informed on farm matters and practices and maintain a sympathetic and helpful interest in the business of each individual farmer. In marketing investigations, a thorough fundamental training in economics and agriculture supplemented by business experience, together with good judgment and some knowledge of rural and commercial psychology are desirable possessions of the investigator.

While actually collecting information and data in the field, he should approach in easy style and see that, as far as possible, there is no second person present at the time of interview. The presence of a second often incites suspicion. The actual questioning should start with simpler questions—those to which the answers will be most easy and in many cases most accurate. These answers may often lead on to other questions and to their answers. It is not absolutely essential, and sometimes not even desirable, to follow the order of questions set in the schedule. Asking too much at the first start off should be avoided and it is better to start first with those questions which would create or incite interest in the mind of the farmer. It would be a tactical mistake to decline any information voluntarily offered. Much time should not be lost in taking down notes. A thorough knowledge of the plan of questions, thoroughly memorised, will help to take down replies quickly and for all questions. One interview is usually better than two or more, excepting, of course, when the plan of continuous record is adopted as in cost or financial accounting. It becomes practically impossible to take down all the information while talking to the farmer and as Mrs. Webb says, "never trust your memory a moment longer than necessary, is an important maxim. All record should, therefore, be immediately copied and checked before one proceeds to obtain information from other farmers. Less stress should be placed on the number of individual records that could be obtained per day and more on the accuracy of results.

C. The Economic Record's Equipment—the Schedule

Apart from the equipment required for physical comforts of the economic recorder and some miscellaneous things as foot-rule, measuring tape, spring balance, etc., the chief equipment of the recorder, while collecting data from the farmers, is the schedule or a systematic plan of questions. Every science requires a systematic plan of collecting information. Statistical analysis forms a necessary part of the final formulation and interpretation of agricultural economic research projects and

for statistical reasons it is absolutely essential that the schedule be finally fixed far in advance before the collection of data in the field is begun. It is impracticable to make any change in the schedule during the course of enquiry. The schedule will have, therefore, to be tried provisionally, all possible sources of error, misunderstanding and border-line cases detected and guarded against and even a provisional statistical analysis made before it is set out for use in the field of enquiry. Every detail in the construction of the schedule, its form, the arrangement of questions, the form of questions and the instructions on the schedule will have to be very carefully thought of beforehand.

The schedule for continuous record plan, as for cost accounting, financial accounting and enterprise cost studies, will have to be specially thought of in accordance with the amount of needed details, but since a large part of general farming and social analysis is possible by visiting the farmer a few times—usually once or twice—it is considered desirable to discuss here the means—the schedule—by which data for such larger analysis is obtained.

(A) The Form of Schedule: (1) The schedule should be of a size convenient to carry about preferably in the pocket without folding. In fixing up the size, the need for filing will also have to be taken into consideration. A formidable size of schedule is likely to create an awe in the mind of the farmer.

(2) The material of the paper of the schedule should be sufficiently thick and smooth, so that one can write easily either with pencil or ink. A good paper gives a better appearance and appearance counts. It is a bad economy to save either in quality or quantity of paper in making a schedule.

(3) Sometimes a colour device is adopted in cases where there are a number of questions, different colours being alloted to different heads of enquiry. This simplifies classification but it is likely to create a feeling of uneasiness in the mind of the co-operating farmer and the field worker is likely to make slight confusion.

(4) Enough space should be kept for writing replies and it is better if the schedule is ruled so that replies may not get mixed up. It is also usual to leave space for additional information on each question and also a reasonably large space at the end of the schedule for supplementary details.

(5) Printed schedules give better results than typed or cyclostyled.

(B) Arrangement of Questions: (1) The arrangement of questions on the schedule should be from simple to complex, impersonal to per-

sonal and least inquisitorial to more inquisitorial. It is always better to avoid questions which are more personal and unnecessarily inquisitorial. Similarly avoid questions whose replies are likely to be given with bias, prejudice or ideas of self-protection. The success of the field worker depends upon his ability to create confidence in the mind of farmers. It is easier to get reliable data once they are convinced that the information given will be kept strictly confidential, names never disclosed,even to State officials, and that the data will have no effect in the matter of taxes. "Since confidence and interest of the farmer are more important, one should begin with the questions which everybody can see and which are, therefore, in no wise confidential, and should end with more delicate questions...."*.

(2) The order of questions should be in some logical sequence, for example, the information on acreage should be asked before data on crop production is asked for.

(3) Heading and sub-headings** should be placed in proper relationships and typing should be in accordance with the importance of a category.

(4) Each additional question means an additional expense and extra work and the number of questions should, therefore, be limited to the bare minimum, eliminating the least essential.

(C) The Form of Questions: (1) The Chief criterion in framing a question is that the person must be able to give a definite and correct reply. For this he must first be in possession of facts sought for in the question and second, he must be asked in the way he carries the facts in his mind. It is on occasions like this that the knowledge of local agricultural practice and rural living becomes of utmost importance to the field worker. The questions must be so simple and clear-cut that even the least educated farmer will be able to answer them.

(2) Only those questions should be put which yield replies in a form convenient for statistical tabulation.

(3) The wording, units and terms used in the schedule should be so clear that misunderstanding will be impossible. As far as possible use of local terms should be freely made.

(4) The questions should be so framed that they do not appear unnecessarily inquisitorial or personal or offensive.

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* Warren, G. F.—Some Methods used in Agricultural Economics Research (Proceedings of The International Conference of Agricultural Economists, 1929, p. 62).

** King, W. I.—Elements of Statistics (Macmillan 1919, p. 52).

(5) The questions asked should, as far as possible, be corroboratory.

(6) The schedule will have been so designed that calculations of related quantities as of production, price, total value, etc. can be made from the simple elements of information.

(D) Instructions on Shedule: (1) The schedule should be accompanied with full instructions on the definition of the different units and terms used. All possible misunderstanding, double meanings and debatable interpretations should be anticipated and guarded against.

(2) A sample schedule properly filled out with definite and clear-cut replies to all questions should form a part of equipment of the economic recorder.

(3) Where desirable, the recorder should be sent out to give a preliminary trial to the schedule and then it will be easier to discover the shortcomings of either the schedule or the recorder or both and provide remedies.

(4) The recorder should be made to memorise the schedule so that he will not miss any point when doing his work.

Checking, Analysis and Interpretations

I. Checking Data

As soon as the data and information are collected, the first thing to do is to transfer them to some permanent record. Checking should be done during the course of transcription. Transferring the data and checking are absolutely essential if the information collected is to be fully utilised. For some reason or the other, the schedules or notes of information are, sometimes simply filed or kept somehow and somewhere till they are required for analysis with the result that a large amount of information which would otherwise have been useful is rendered useless. This is particularly likely to happen in a continuous record plan study, like the cost of production of different crops, where schedules are received at regular intervals. It is sometimes thought that nothing need be done with such schedules till data for the full stipulated period are obtained. Few people realise, until hopelessly involved, the mass of data that accumulates in such studies. If not regularly and properly posted, a large part of details is likely to be neglected because either of the unmanageable bulk or of some other shortcomings. Posting of data is tiring to most people, but it is one of the essentials and inevitables of good and thorough work.

It becomes often necessary to fill in gaps of some missing replies in the schedule on the basis of average. It is best first to analyse the possible causes of omissions which may be due to negligence, oversight, indifference or abnormality. In case abnormality is suspected it is better not to fill in the gap, more particularly when variations are to be studied. It is advisable to determine in advance the maximum number of gaps that could be filled in a schedule. It is no use going on filling a large part of a schedule on the basis of average. If the object of enquiry is to study variations among cases, it is not desirable to fill in gaps.

Sometimes the returns may be abnormally low or high. Where the number of cases is sufficiently large such abnormalities cancel out. But when it is not so and statistical analysis is still desired, it is usual to drop such abnormal cases. But genuine abnormal cases have their own use and possibly it is these which suggest basis for improvement. The causes of abnormality should, therefore, be analysed. Where the object is a simple description of type, such abnormal cases are usually omitted.

II. Statistical Analysis

After the data have been checked for accuracy, it is ready for analysis. It is at this stage that the method of statistics may become an indispensable aid to agricultural economics. The work of the economic statistician begins where the economic recorder leaves off. His material is numerical referring to mass phenomena. The economic recorder studies individuals or units, while the economic statistician observes aggregates with a view to studying the possibility of extended application of the knowledge obtained from the study of individuals or units. The statistical analysis performs two functions. First, it helps to describe specific mass phenomena by providing such means for the presentation of data as tabulation, graphic representation, measurements of variation and relationships and other statistical devices which enable us to draw conclusions from the data collected and secondly, it enables, with proper precautions, to estimate inferences of the unknown universe on the basis of results obtained from sample data.

The first logical procedure in the organisation and analysis of data is to group them in some related and logical manner. Possibly the best and universal method of reducing data of mass phenomena to a concise, condensed and manageable form is of **tabulation.** Tabulation is an extremely important part of any statistical analysis since it forms the basis of further analysis and a part of final results and as such it deserves a careful consideration.

The chief **function of tables** is to show in a summary and related form a mass of quantitative data. A summary is essentially a short and

self-explanatory statement and as such a table must be self-contained. **Bowley** advises that it is better many times to tabulate in three successive stages: First, the construction of tables of record or reference in full detail of all the collected material; second, the tabels of exposition, analysis and discovery under different headings; and third, the tables of summary of results. The second set of tables is constructed from the first and the third from the second. The first set is necessarily contructed first and it is from this set that the analysis must follow.

Before proceeding to construct the form of a table, it is necessary to define the purpose of its construction. One of the important uses of tables is the illustration of comparisons and in order that comparisons could be easily comprehended each table should present one comparison and form one unit. If more than one comparison is included in one table, the result might become obscure. It is sometimes thought that one table has the advantage of compactness and places all the relevant data at one place. But it usually becomes too large and clumsy to understand comparisons significantly.

Another thing to be decided in the construction of tables is whether absolute numbers, percentages or ratios should be used for inclusion in tables. Absolute numbers are, sometimes, too large to be easily comprehended or may be of such nature that they will not give correct idea. Thus, for example, it is the proportion of area under a particular crop of the total cultivated area of a district which will give a better idea of the relative importance of that crop in that district than the absolute figures of acreage though this may not always be the case. Similarly, figures of death rate, birth rate, etc. are better understood by ratios. But these proportions, ratios, etc. (called statistical coefficients by **Bowley)** may sometimes convey wrong impressions and it is better, therefore, to give proportions, etc. along with absolute figures.

The **title of the table** should be clear, concise, complete and self-explanatory. More attention should be given to explanation than conciseness and the title should show all the material assembled in the table. Similar care will have to be taken of the titles or headings and sub-headings of rows and columns which should be numbered for easy reference. Supplementary explanations of headings, sub-headings, etc. as well as the sources from which secondary data may have been taken for the compilation of the table should be given in foot-notes. The figures in the table should be totalled at the end of either the rows or columns and the totals checked.

The best way of reducing a mass of quantitative data in a form which will bring out the characteristics of the mass as a whole is to

construct a **frequency distribution table.** It is a process of putting things in more or less homogeneous groups or classes in accordance with the extent to which they possess certain selected common attributes. It has to be noted that when we classify things or units in this manner, we must recognise that though all units have some attributes in common, they are not at all equal. We simply suggest that **within classes** all units are equal or nearly equal.

Individuals vary in their characteristics and the chief purpose of arranging data in frequency tables is to show the nature of the distribution of the variable characteristics. The variation may be in size, quantity or time. In constructing distribution tables, the number of classes should be sufficiently large to approach as nearly as possible the details of data. But since the object is condensation, the number has to be limited, the exact number being usually left to the judgment of the statistician. In general, the number depends on the number of cases in the data.

After the data have been grouped in frequency tables, the next step will be the determination of measures for expressing the more important characteristics of the data shown by distribution tables. If the data collected are adequate, the distribution will normally show a grouping of items at the centre and the measurements of central tendency are known as **averages.** The most important use of averages is in the description of a large group of data. There are five forms of averages, the three **means**—arithmetic, geometric and harmonic—and the mode and the median. The **mean** takes into account values of all observations, the **median** is the middlemost item while the **mode** is the middle point of the class of greatest concentration. Each has its own importance and significance.

Averages describe the central tendency but they do not give any idea of the degree of variation or dispersion in the frequency distribution. **Measures of variation or dispersion** have therefore to be used and these show the average extent to which the items in the series depart from the average.

Periodical distributions, known as **time or historical** series, show chronological fluctuations. The four types of such fluctuations are, the **secular** or long-time trend, the cyclical or those depending on the swings of business periods of depression and prosperity, the **seasonal** or short-time variations usually covering a twelve months period and **accidental** or those due to unforeseen causes. Normally, each of these fluctuations is due to a different set of causes and the general object in the analysis of time series is the isolation of effects of one or more of these fluctua-

tions, in order to study the effects of the rest. All the forces of fluctuations are acting simultaneously and the value of studying the effect of a single force will, therefore depend upon the success of completely eliminating the force of the effects of the rest. So far, no method has been evolved of keeping in complete suspense the effects of any one of these forces. While it is doubtful if such a method could ever be evolved because of the impossibility of completely isolating economic forces, it is recognised that it may become possible to approach closely the real truth in a statement respecting any economic force partly by induction and partly by deduction.

For the methods of analysis in use, it is assumed that the data in the time series are homogeneous as regards the methods of collection and compilation as well as the underlying economic and social conditions during the period covered by the series. It is very seldom that these conditions are completely satisfied especially when data referring to the remote past are to be used, as for instance, in the analysis of farm price data. The whole analysis bears directly upon the study of the social and economic forces during the period covered by the analysis. Under such circumstances, the results of such analysis will be found more useful for checking theoretical conclusions. If the results agree with theoretical conclusions, they will have to be tested by further analysis of similar nature. If not, we have to search for other causes. It is quite possible that results of even carefully computed inductive analysis may not agree with theoretical conclusions based on deduction and in such a case the inductive conclusions will have to be further tested till they arrive to the rank of an independent theory. The chief object in the analysis of time series is to study the past events with a view to foretell the future and the main question in forecasting is whether we can depend on **repetition** in economics. In some other sciences the present tendency is towards attaching more importance to proof by repetition or proof of experiment than to reasoning from cause to effect. Admitting that arrangement of proof by repetition (or experiment) is difficult in economics, it is possible that we **may** have to accept proof of repetition—if there ever be any—as statement of effective truth even against the established deductive principle.

Correlation analysis is a very laborious process and before attempting it, it is very essential to make a serious effort to think of the causes connecting variables. Each variable to be correlated must be as simple as possible. If it is complex, the results cannot be isolated and correlation analysis loses its significance. Thus, for example, a high correlation between net income and gross receipts will convey little dependable idea since both these variables are complex. Net income may depend on size

and organisation of business and gross receipts on returns from different enterprises and prices received. When variables are reduced to their simplest form, the number of variables so simplified becomes too large for analysis and the usual procedure is to select the more important ones. One of the greatest difficulties in getting significant results which would elucidate causation from correlation analysis is the adequacy of data. The value of correlation coefficient depends on the smallness of probable error and the probable error is small when the number of obsevations is sufficiently large. Another shortcoming is that cause and effect cannot be determined by correlation. Two variables may closely associate together but we cannot, by mere correlation coefficients, say which is cause and which is effect, or sometimes they may have no causal relation whatsoever. In such cases conclusions are to be based on general knowledge.

When the question comes of using the correlation analysis for predicting what some other similar period of time or number of cases or community will be like, then the problem arises as to how good the sample studied is and how far the conditions of the time, cases or community, for which prediction is desired, approach the conditions of the sample studied. The process of reasoning to causation—correlation—prediction—depend upon the assumption of continuation of more or less equal conditions: that the environment, so to speak, remains static, while the dynamic forces causing limited changes continue to operate or are repeated in the same ways and to the same extents as in previous times. In an ever-changing economic world, such an assumption will not always be safe. A new dynamic force may upset the relationships. The probability that the same variables will give the same or similar results in the new period as in the old is, therefore, a matter that cannot be entirely determined by any mathematical procedure. It must be reasoned on the basis of economic and other related facts and principles.

The method of statistical analysis is a very recent development and the premises and hypothesis on which some of its measures are based still remain to be proved. Possibly the whole theory of modern statistical method is based on the theory of probability and of sampling. Statistical results are reliable so far as they are based on methods in which the mathematical pre-suppositions are applicable to the data used. The more complicated methods of statistical analysis such as the analysis of time series and the correlation analysis are too laborious and risky for a new and unwary investigator. A large part of his time and energy may be spent in such calculations with the result that he may not devote the full and required attention to the interpretation of results in their clear significance. Of the various forces affecting the socio-economic

world some are measurable in quantitative terms, while others are not. It may not help much to correlate only the measurable forces. Another characteristic is that these forces are never static and conditions never remain exactly the same. That means that the margin of variability in results must be greater than in the physical and biological sciences where conditions are more stable. The interpretation of statistical coefficients must, therefore, involve other types of facts as well and we must constantly combine the statistical and the non-statistical data in order to understand correctly the causal relationships. Results obtained by induction from statistical analysis must, therefore, be supplemented and checked with deductive and theoretical conclusions. It is always safe to proceed with the inductive statistical analysis after a careful deductive analysis of the problem has been made.

III. **Interpretation**

After analysis, the next step will be the presentation and interpretation of results. There cannot be any general rule for presenting results, but the logical procedure seems to be to divide the results into parts with some causal sequence. Apportionment of space must be made in accordance with the importance of different parts. It is not unusual to find too large a space allotted to details of exceptional cases or unusual occurrences which surprise the eye the most. Exceptional cases have their own value but in a study intended for generalising a large field, they vitiate results. An exceptionally profitable unit may serve as an ideal towards which to work and provide an inspiration which leads to improvement. Or it may be useful in demonstrating a principle or for illustrating an idea or plan of reorganisation. Tables of exposition and illustration must be included in the text at places where they are explained but detailed tables of reference from which illustration tables are constructed may be given at the end. It is many times desirable to illustrate results by means of graphic representations, such as graphs, line or bar charts, pictograms, dotted and hatched maps, etc. more particularly when results are intended for popular use.

Interpretation is the crowning piece of any research. This requires creative imagination, adequate literary expression, courage and caution in making statements and honesty of purpose. Complete knowledge of the whole field of research and of the methods of collecting and analysing data is necessary. A good many conclusions will be provisionally predicted while making preliminary analysis of the problem and results will have to be checked with such hypotheticated conclusions. There is a danger of mis-using the random sample. The chief assumption in the theory of random sampling is that certain number of items selected at random will represent the whole iniverse. Circumstances will determine

how large a sample is necessary and possible in any particular case and no generalisations of the whole universe should be attempted until there are reasonable grounds to believe that the sample represents the universe in all the particulars. Temptation to generalise from an inadequate sample is sometimes too strong. Often, generalisations have to be expressed as mere impressions but such should be explicitly so stated. Whether the conclusions are reached by induction from analysis of data or by deduction from established general knowledge, they will have to be tried and tested before they rise to the rank of principles.

The principal aim of agricultural economic research is the formulation of sound principles and suggesting remedies not only to the individual farmer but also to the authorities concerned in the organisation of assistance to the farming community and the formulation of agricultural policy. It is true that some planning and direction of rural economy and social activities has always occurred, and indeed must continue to occur. The time has, however, passed when this should be attempted without as full an understanding of all the conditions and forces as possible and the durability and reliability of action would undoubtedly depend on the soundness of the methods adopted and conclusions reached in agricultural economic research. Every research project must, therefore, ultimately end in making concrete and practical suggestions to all concerned in the improvement of the existing situation.

At a time when due to the unreliability of basic data relating to our agricultural economic life, our plans and actions, whether in making the country self-sufficient in this or that or in other spheres, are not meeting with expected response and success, a plea for a patient, scientific, realistic approach in the study of the various socio-economic problems of Indian agriculture and an emphasis on systematic, sustained economic research in agriculture, which have been the burden of my address, must find an echo in all hearts; but the bright day for economic research in agriculture will be, when the hearts are moved to action and effective arrangements for carrying out economic research in the patient, unhurried, sympathetic and scientific way are made, not only by the different governments but also by Universities, enlightened men of substance, and philanthropically inclined individuals.

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