INDIAN STATISTICAL INSTITUTE

ANNUAL REPORT 1953-54

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INDIAN STATISTICAL INSTITUTE

TWENTYSECOND ANNUAL REPORT : 1953-54

1. INTRODUCTORY AND HISTORICAL REVIEW

0.1. The Indian Statistical Institute has completed twenty-two years of its existence. The Institute, which had a small and modest beginning, has many sided activities in research in mathematical statistics, professional training at post graduate level, large scale sample surveys and applied projects, a computation laboratory with mechanical and electronic equipment, a scientific journal and associated press and publishing concern, and its own workshop, carpentry and construction section. The Institute has at present many responsibilities both in the advancement of statistics and in planning for national development. It has to prepare itself to undertake still greater responsibilities in future. A brief review of the Institute's growth of activities is given in the next section.

0.2 Shri Chintaman Deshmukh, Finance Minister, and President of the Institute accompanied by Shrimati Durga Bai stayed in the Institute from the 13th to the 16th December 1953. Shri Chintaman Deshmukh presided over the Anniversary Day celebration on 13 December 1953 which was attended by about 1500 present and old students, present and old workers, and friends of the Institute. Professor Mahalanobis gave a brief review of the progress of work. Shri B. Rama Rau, Governor of the Reserve Bank, and Vice-President of the Institute, and Professor S. N. Bose, Vice-President made short speeches. Shri Chintaman Deshmukh awarded certificates to 23 trainees of the International Statistical Education Centre and then addressed the meeting (a summary of which is given at the end of this section, page 10). Refreshment was served after the meeting and was followed by a musical programme arranged by the Institute workers and an exhibition of folk dances with music of different Asian countries arranged by the ISEC trainees.

0.3 Jawaharlal Nehru accompanied by Dr. B. C. Roy, Chief Minister of West Bengal, visited the Institute on 15 December 1953 and looked round the different sections. The Prime Minister noted with interest the new developments since his previous visit.

1.1. Origin and Growth

1. The origin of the Indian Statistical Institute can be traced to the early statistical work of P. C. Mahalanobis on biometry, meteorology, and anthropometry which began about the end of the first world war. A few part-time assistants and a group of young research workers under the professor had formed the nucleus of a statistical body which came to be known as the Statistical Laboratory and was located in the Presidency College, Calcutta. Extensive investigations were made by this group on rainfall and floods in North Bengal, Orissa, and West Bengal leading to effective measures for flood control and supplying the basic calculations for two great river valley schemes in later years, namely, the Damodar Valley and the Hirakud projects. Official recognition of the Statistical Laboratory in a

continuing form came in July 1931 with an annual grant of Rs. 2,500 from the Imperial (now Indian) Council of Agricultural Research for statistical investigations relating agriculture. Training on an individual basis started at the same time.

2. The Indian Statistical Institute which came into existence in December 1931 was formally registered under the Societies Registration Act in April 1932. Since then the Institute has been functioning in law as a non-profit 'learned society'. The Statistical Laboratory was the active nucleus of the Institute and the work of both the Institute and the Laboratory used to be done from the very beginning in the form of a single integrated operating unit. With the accumulation of research material for publication, *Sankhya : the Indian Journal of Statistics* was started in 1933 and has since then been functioning as the medium of advanced statistical publication in India. Society type branches were established quite early in Mysore, Poona, Bombay, Madras, Lahore, Banaras, Lucknow and Delhi.

3. In the early years the Institute and the Laboratory took up many small enquiries on behalf of Government departments and private concerns. Large scale surveys started in 1937 with the institution of a Government scheme for improving the forecast of the area under jute in Bengal and since then the Institute has been carrying out on an increasing scale enquiries and surveys on behalf of Government. The larger part of the income has always been derived as contract grants for projects and enquiries. The first general grant for research and training of Rs. 5000 per year from the Government of India began in 1935.

4. Many ventures in research and project work met with success, earning recognition for the Institute both within and outside India. The Institute also enlisted the support of statisticians from abroad, such as Professor R. A. Fisher who came to India to preside over the first Indian Statistical Conferences in January 1938 and Professor Harold Hotelling who came as a visiting professor in 1939–1940. Since then (with an unavoidable break during the war) the Institute has maintained the practice of inviting distinguished foreign statisticians to work as visiting professors in the Institute.

5. The war period brought in many environmental changes. A large part of the Institute and Laboratory was removed, as evacuation measures, to Baranagar and Giridih where operating centres were opened in 1942. With increasing need of statistics by Government the project side of the Institute also developed rapidly. The sample survey in Bengal was extended to cover both the area sown and the total yield of jute, rice and other important agricultural crops throughout the year. Full-scale sample surveys of agricultural crops began in Bihar in 1943. The tabulation, on the basis of a two per cent sample, of the 1941 Population Census started in 1944-45; and various socio-economic surveys were also undertaken.

6. The post-war years also have been a period of rapid expansion and new developments. The question of stabilization of the Institute had been under consideration by the Government of India since 1938 but had reached a deadlock owing to basic differences of opinion between the Institute and the Department of Education. At a critical period in its history Shri Chintaman Deshmukh agreed to become the President of the Institute in 1945 and since then has been quietly helping in solving its many difficulties. Mainly through his efforts the Research and Training School was stabilized with an initial recurring

grant of Rs. 4.5 lakhs from the Government of India from 1949-50; the administrative sponsorship was transferred from the Ministry of Education to the Ministry of Finance in 1950; and a Governing Body was established in 1952 to look after its affairs subject to general coordination of the work of the Institute as a whole by the Council.

7. The International Statistical Education Centre (ISEC) was started in October 1950 under the joint management of the International Statistical Institute and the Indian Statistical Institute under the sponsorship of the United Nations Educational and Scientific Organization and with the cooperation of the United Nations and associated international agencies. Since then the ISEC has been providing training for students for Asian countries with the full support of the Government of India.

8. On the project side the sample survey of crops in Bengal, which had been started by the Institute in 1937, was handed over as a going concern to the Government of West Bengal in 1951. However, a year earlier the Institute had taken up an even bigger project, namely, the design and analysis of data of the National Sample Survey which was started by the Government of India in 1950. In 1953 a new line of work opened up with the establishment of a team of whole-time workers in Statistical Quality Control financed by the Government of India.

9. The computational work was steadily mechanized with punched card (both Hollerith and Powers-Samas) machines. The need of high speed computations led to the establishment of the Electronics Laboratory on an experimental scale in 1950. Gradually a good workshop was built up which took over the servicing and repair work of all desk calculators in the Institute. In 1953 a small electronic analogue computer of a novel design was constructed to solve linear equations in 10 variables; and early in 1954 work was started on the construction of a large capacity digital computing machine.

10. The need of accommodation was growing with increasing commitments. A large part of the Institute had been located in Professor Mahalanobis's house at 204 Barrackpore Trunk Road since 1942. An adjoining plot of land of about 3 acres was acquired in 1950 and a building was constructed in 1951 and was dedicated by Professor R. A. Fisher in the same year. An operating branch had been in existence at Giridih (in Bihar about 200 miles from Calcutta) since October 1941; and a 35 acre plot of land (partly agricultural) was acquired there in 1952. Since 1937 or so, the Institute has also been using rented accommodation in Calcutta, Baranagore and Giridih. A number of rooms in the Presidency College, which the Institute had been occupying from the beginning, were vacated at the end of 1953.

11. The post-war years were also a period of increasing recognition of the work of the Institute. Professor Mahalanobis was elected a Fellow of the Royal Society in 1945 and began serving as a member of the United Nations Statistical Commission in 1946. He served as the Chairman of the UN Subcommission on Statistical Sampling from 1945 to 1951, and also as member of various international committees and organizations. Other workers of the Institute began to have assignments in Europe and America and represented the Institute at international meetings and conferences. The Institute acted as the host society to the International Statistical Conferences in India in December 1951 and a part of the scientific session was held in the Institute premises in Calcutta.

12. Since 1945 when R. A. Fisher came for the second time many distinguished scientists were coming as visiting professors among whom many be mentioned the names of Walter A. Shewhart (Bell Laboratories, New York), Herman Wold (Uppsala, Sweden), Abraham Wald (New York), J. B. S. Haldane (London), William Hurwitz (Washington), Frank Yates (Rothamsted, U.K.), Arthur Linder (Geneva), M. Masuyama and T. Kitagawa (Japan), H. Theil (Netherlands), J. Durbin (London), and Charles Bettelheim (Paris).

13. Since the appointment of Professor Mahalanobis as Honorary Statistical Adviser to the Cabinet, Government of India, the Institute has become more and more closely associated with the work of the Central Statistical Organization and other Government agencies in New Delhi. In accordance with a decision of the Government of India of 1952 the Institute is functioning as the focal centre for professional training and research and as a National Statistical and Computation Laboratory in India; and in 1953 operational research relating to planning was started in the Institute with the help of a special grant from Government.

14. The Institute has at present a number of sections and divisions. The Research and Training School with Dr. C. R. Rao at its head has won international recognition for researches in mathematical statistics and provides professional training at the post-graduate level. The International Statistical Educational Centre provides education and training for students and officers on deputation from the different Asian countries. The Projects Branch under Shri J. M. Sengupta and Shri D. B. Lahiri is handling the statistical work of the National Sample Survey which covers about 1000 villages and over 50 cities and towns one round after another every year, and is the most comprehensive socio-economic survey on a continuing basis in the whole world. The Mechanical and Electronic Computer section under Shri Samar Mitra is in charge of the workshop and the development of high speed computers. The Machine Tabulation section under Shri Nares Datta is the biggest installation of its kind in India and is equipped with several large tabulators, multiplying punches electronic machines (No. 101). The Library under Shri Jibananda Saha has a collection of about 47,000 volumes and is receiving over 800 journals, reports, and abstracts from all over the world and is one of the best statistical libraries in the world; there is an attached photographic section with micro-film, photo-stat and other equipments. The Estate Office under Shri Subodh Das Gupta was responsible for the construction of all Institute buildings departmentally so far, and is responsible for the maintenance of lands and buildings both at Baranagore and Giridih. There is a Social and Welfare Section and a House Committee with Srimati Rani Mahalanobis at its head which looks after the medical welfare unit, the students' hostel, kitchen, canteen, and hospitality arrangements for visiting scientists from abroad. The total staff at Baranagore and Calcutta is at present about 550; and in addition a field staff of 150 under Shri Pranaya Kumar Chatterjee engaged in special enquiries in West Bengal. There is a 35 acre farm and an operating branch with a working staff of about 70 at Giridih; a whole-time SQC Unit under (Miss) S. P. Vaswani in Bombay, and an office in New Delhi with society-type branches in Bombay, Poona, Delhi and Madras.

15. With expanding activities the Institute budget also has been steadily increasing. As already mentioned, the Statistical Laboratory had received its first recurring grant of Rs. 2,500 in 1931-32. The combined budget for the Laboratory and the Institute was less than Rs. 4000 in 1932-33, but gradually the current expenditure increased to Rs. 1.25 lakhs in 1941-42; Rs. 20.40 lakhs in 1951-52 and to Rs. 33 lakhs in 1953-54.

1.2. Research Contributions

The results of theoretical and applied researches have been given in over 800 original papers and reports. Some of the important lines of work are indicated below.

1. In the theoretical field the first important work centered round problems of discriminatory analysis. The concept of a measure of divergence between two populations as an aid to classification was introduced by P. C. Mahalanobis from the Statistical Laboratory in 1925 and was later developed in a paper (1927). Further progress was made when a proper mathematical form was devised for classification of groups in terms of mean values only of the variates (1928). The classical and studentised D^2-statistics introduced for this purpose are now well known. Some of the distribution problems connected with them were solved by R. C. Bose and S. N. Roy between 1934 and 1939. Mathematical properties and practical applications have been investigated since 1939, and a fairly satisfactory approach to the entire problem of classification of groups is now available. The first major application is contained in the report 'Statistical Analysis of U.P. Anthropometric Survey' printed in *Sankhyā* (1949).

2. Classification and discrimination in terms of second order characteristics (variances and covariances) were taken up for systematic study by S. N. Roy from 1939-40, and considerable progress was made in the construction and use of suitable functions for measuring group divergences in respect of second order characteristics.

3. The problem of allocating an individual to its proper group was investigated by C. R. Rao when the alternative hypotheses are more than two (1948) and also when the alternatives are not completely specified as when the parameters need to be estimated from samples (1953). More general problems of selections have also been developed by him (1951-53).

4. Considerable attention was also given to the theory of the Design of Experiments by R. C. Bose, K. R. Nair, K. Kishen, C. R. Rao and other Institute workers from 1938. Researches in the construction and analysis of balanced incomplete block designs were initiated in 1938. With the application of the theory of Galois fields by R. C. Bose it was possible to obtain all the known solutions previously given by Fisher and Yates together with a number of new solutions (1938). Further work led to a convenient representation of all practically useful balanced incomplete block designs.

5. The problem of confounding had been studied exhaustively at Rothamsted for the simpler designs of the 2^n and 3^n types, i.e., of n factors at 2 or 3 levels each respectively. The more general solution in the case of s^n design (where s is a prime number) was supplied by R. C. Bose and K. Kishen from the Indian Statistical Institute by using the properties of the s-sided hyper-Graeco-Latin squares (1938) and later with the help of finite projective geometry (1940). The problem of confounding of interactions in asymmetrical factorial experiment was studied in a series of papers by K. R. Nair and C. R. Rao from 1941. All possible confounded balanced designs in the case of symmetrical factorial design s^m in blocks of s^n plots have been constructed by R. C. Bose (1946). Using some number theory results, compact representations of finite geometrics have been obtained by C. R. Rao to enable the construction and analysis of confounded factorial designs by punched card methods (1951).

6. A proof was supplied by R. C. Bose for Euler's conjecture that completely orthogonalised sets of s-sided Latin Squares can be found so long as s was a prime number or power of a prime number (1938). Systematic methods of construction of such squares, which are of great importance in the practical designing of experiments, were investigated.

7. K. R. Nair and C. R. Rao developed two types of incomplete block designs (i) general class of partially balanced incomplete block designs (1940-41) which includes as special cases the balanced and quasi-factorial and (ii) the intra and intergroup balanced designs (1940-41) which are useful in many practical situations. A general method of approach for recovering the intra and inter-block information from the results of a general incomplete block design and the necessary tests of significance have been given (1948).

8. Important contributions were made by Mahalanobis from 1938 on the mathematical foundations of large scale sample surveys. The economic aspects of conducting sample surveys were mathematically formulated and studied in detail. Also for the first time the concept of non-sampling errors were introduced and suitable statistical techniques in the form of independent inter-penetrating net work of samples were devised to control such errors. The theory and application with special reference to surveys conducted in Bengal were published in the Philosophical Transactions of the Royal Society (1944). More recently D. B. Lahiri has been working on the theory of sample designs. He gave an extremely simple rule for the selection of sample units proportional to size (1951) and has developed ingenious methods of increasing the efficiency of the National Sample Survey. Methods of estimation in multiphase and multistage sampling have been investigated by Des Raj in the most difficult situation of varying probabilities of selection without replacement.

9. The problem of unbiased estimation has been extensively studied starting with some inequalities for the attainable variance of an unbiased estimate found by C. R. Rao (1945). It was also shown in 1945 that minimum variance estimates are explicit functions of sufficient statistics and a method was supplied for improving an estimate by finding its conditional expectation given the sufficient statistics. The above inequality was improved during 1946–1948 by A. Bhattacharya. Several results of a general nature in unbiased estimation have been found since 1948 by C. R. Rao, D. Basu and S. Mitra.

10. Besides, in recent years, some multivariate tests were developed and their optimum properties investigated by C. R. Rao and J. Roy. A simple technique for finding powerful approximations to a complicated distribution has been found and applied to several multivariate tests based on the likelihood ratio criterion (1951).

11. There were a number of contributions by D. Basu and R. G. Laha on the characterization of the normal distribution from the point of view of stochastic independence of some statistics and of independence of conditional expectations. Two important cases considered are independence of two linear functions of identically distributed independent variables (1951) and of the average with any sample cumulant (1953).

12. One of the new lines of research started in the Institute is the study of limit theorem in probability. G. Kallianpur investigated the behaviour of successive sums of independent random variables and their equidistribution on the real line. A general theorem of the Lindeberg type has been proved for the convergence to normality of sums of 'm-dependent' random variables (1953).

There have also been a large number of other theoretical contributions from time to time in the applied fields such as Biometrics, Psychometrics, Quality Control etc.

1.3. Applied Work

1. The early work on anthropometric measurements (1921) by P. C. Mahalanobis led to the formulation of the generalized distance (D^2-statistics). His next two papers were on upper air correlation and the seat of activity in the upper air (1922) which led to detailed investigations on rainfall and floods in North Bengal (1926) and supplied the basis for effective measures for flood control. This was followed by extensive studies on rainfall and floods in the Orissa rivers (1930) which on one hand, led to flood control measures for the Brahmini river and, on the other hand, supplied the basic calculations for the Hirakud irrigation project. In the same connexion may be mentioned the studies on the Burdwan-Hooghly-Howrah Flushing and Irrigation Scheme (1936) which were connected with the later development of the big Damodar River Valley project.

2. In an early paper Mahalanobis (1925) had attempted to eliminate variations in yield arising from differences in soil fertility in a variety trials on rice. At this time he had no knowledge of R.A. Fisher's paper or field trials of 1923 or 1924. But his paper was seen by Fisher which put him in touch with Fisher's work on design of experiments the far-reaching importance of which was immediately appreciated by Mahalanobis. In 1927 Mahalanobis met Fisher at Rothamsted and was eager to introduce the Fisherian technique on his return to India. This important line of work opened up with the sanctioning of an annual grant of Rs. 2500 for this purpose by the I.C.A.R. in 1931. During the next 10 years the Statistical Laboratory and the Institute functioned as the focal centre of work in the design of experiments. More than 60 papers were published by the Institute workers up to 1942 when the grant from the I.C.A.R. was discontinued. Mahalanobis and S. S. Bose and their younger colleagues participated in numerous discussions, meetings, and conferences to promote the use of design of experiments. The Statistical Laboratory and the Institute also undertook the task of providing training in this subject to a large number of agricultural scientists from all over the country.

3. A number of small sample enquiries had started in the middle thirties mainly relating to consumer preference for particular types of goods (1935) or such questions as the incidence of drinking tea in Calcutta. The subject opened up on a really grand scale with the initiation in 1937 of the five-year project for the improvement of the forecast (or rather, the estimate) of the area under jute in Bengal which is an important cash crop of the country. The sample survey of the jute crop in 1937 was a land-mark in the history of the Institute. From then on, the sampling method came to stay and sample surveys of agricultural crops and large-scale economic and social surveys of all kinds became a very important field of activity of the Institute. A survey of family budget was conducted in 1938-39. Extensive work was started in 1939 on crop-cutting to estimate yield per acre. Between 1943 and 1945 two sample surveys were rapidly conducted on agricultural crops in Bihar with encouraging results. J. M. Sen Gupta supplied the leadership among younger workers on the statistical side form the very beginning ; and Nihar Chandra Chakravarti was responsble for much of the deve ofments on the fild side.

4. Among other projects conducted by the Institute between 1944 and 1948, mention may be made of surveys on economic aspects of road development, rural indebtedness in Bengal, economic and social condition of agricultural labour, middle class family budgets, sample surveys of traffic on Howrah bridge and survey of displaced persons in

Delhi. Investigations on employment, cost and standard of living, and consumption patterns were also made. A sample survey on economic conditions in Rangoon was organised by the Institute in 1948-49 at the instance of the Government of Burma.

5. Besides conducting large-scale sample surveys, many methodological researches were undertaken on such subjects as the personal bias of the investigating staff, use of replicated sub-samples, use of inter-penetrating samples, configurational sampling, zonal and non-zonal randomisation, duplicated sample-units, sequential surveys, planning of sample surveys, experiments on crop estimating, control of observational and computational errors etc.

6. Another important project was started in 1945. Tabulation of the 1941 Census of Population had been kept in abeyance as a measure of war economy but there was continuing and pressing need of demographic information. At the suggestion of the Institute, the Government of India sanctioned a large-scale project to prepare age and occupational tables on the basis of the two per cent sample of the Census slips (which had been fortunately preserved under the instructions of the late M. M. Yeatts, Census Commissioner). The work was taken up by the Institute in 1945 and completed in 1950 under the guidance of D. B. Lahiri.

7. The Institute was called upon in 1950 by the Government of India to take up the design and analysis of data of the National Sample Survey (the field branch of which has been all along working under the direct control of the Ministry of Finance). Several rounds of the NSS have been conducted and extensive information has been made available on the economic conditions of the whole country. Some reports have been published and the data already collected offer much scope for research and analysis on problems relating to planning for national development.

8. As early as 1935, the Institute had recommended that the Government should take appropriate measures to initiate Statistical Quality Control methods in Indian industries. Dr. Walter A. Shewhart (the originator of Statistical Quality Control) came to India at the invitation of the Institute in 1947-48, toured the country, held conferences and stimulated interest among industrialists. In 1952-53 a team of SQC experts sponsored by the United Nations Technical Assistance Administration visited India and conducted intensive training courses in SQC methods in different parts of India. The Institute functioned as the host society and in collaboration with the Central Statistical Organization made arrangements for these courses. More recently the Institute established full time SQC units to function in different parts of the country with financial support from the Government of India.

9. The Institute has also been engaged in many other types of applied work such as intelligence and aptitude tests, anthropometric studies, time series, biometric investigations and operational research.

1.4. Training and Examinations

1. Training of officers deputed by the Central and State Governments had started in 1932. In the earlier years training was provided more or less on an individual basis. Between 1932 and 1939, more than 150 individuals had been given such training, but the demand was gradually increasing and the Institute started organised courses of instruction

from July 1939. Since then the training courses have gradually developed into a professional training school. The Institute at present provides a two-year training course for advanced students who have already taken the master's degree in mathematics or statistics. After a further period of professional and research work, the candidates proceed to the Associateship of the Institute (which is equivalent to a doctor's degree) on submitting a thesis or report on applied work.

2. A small batch of probationers or apprentices are taken periodically, who attach themselves to some major project work and thus get their grounding in statistical work. Facilities are provided to officers on deputation from Government departments or scientific institutions for advanced and specialised studies. To junior workers of the Institute as well as to suitable candidates from other fields, special courses of instruction in computation are given. Between 1932 and 1954, more than 750 persons received training in one form or other at the Institute.

3. Since 1938, professional examinations have been conducted for the award of Certificates for Computers and Field Investigators and Diplomas for Statisticians. The diploma holders can qualify for the Associateship of the Institute after a prescribed period of applied work. About 1750 candidates have registered for these examinations and 603 have passed up to 1953.

4. Another pioneering venture made by the Institute was the institution, in 1950, of the International Statistical Education Centre in collaboration with the International Statistical Institute under the auspices of the UNESCO and the Government of India. Courses of professional training have been provided to more than 190 students from Asian countries over a six months period in the early years and a full academic year since the year under review.

INDIAN STATISTICAL INSTITUTE

SPEECH BY SHRI CHINTAMAN D. DESHMUKH, PRESIDENT OF THE INDIAN STATISTICAL INSTITUTE ON THE ANNIVERSARY DAY AT BARANAGAR ON 13 DECEMBER 1953.*

Workers, sympathisers and friends of statistics :

I am indeed very happy to be able to be present here on the 22nd Foundation Day of the Institution. I have heard Professor Mahalanobis a moment ago. My own acquaintance with him is older than my acquaintance with the institution. We were at Cambridge, but not together. He had left when I went there. When I came to Calcutta in 1920, I happened to be his guest at 210 Cornwallis Street. It was then that I learnt something of his interest in statistics. I believe he was then interested in meteorological statistics, although he was then a teacher of mathematical physics. Going back to these days, it is extra-ordinary that one who was not a statistician at all should have been instrumental in founding this Statistical Institute which is acknolwedged today among the foremost Statistical Institutes in the world, and the way in which it has been built up is also magical.

As the Professor has already told you that he had been assisted in building it up by people, among whom there have been businessmen like our honoured Vice-President Shri Ram and very often captains of industries like the late R. N. Mookerjee and other noted persons in many walks of life. He also recalled the humble workers who are not mathematicians or statisticians and who have helped him. and among these workers I count myself. There was not much interest for myself in mathematics in my school and college days. I was more interested in language and literature. Anyway, when I was a Joint Secretary in the Ministry of Education, Health and Welfare in 1939, he told me of the trouble he had been experiencing in interesting persons in Delhi in the work of the Institute. I believed then a great question was being debated in Delhi in consultation with the Economic Adviser (Dr. Gregory) whether a grant of Rs. 38,000 should be given to the Institute or not. I believe that the judgment was that it should not be given.

By that time I had something again to do with statistics. I had done a land settlement in one of the districts in Chatrisgarh, and in the course of that settlement I had carried out a random sample survey of rice yields and made about 3000 crop-cutting experiments between 1927 and 1931, eight years before I heard about the difficulties in regard to the development of the Institute. Soon after that, my lot was cast with the Reserve Bank of India and there I had a legitimate field in which to take some interest in the work of the Indian Statistical Institute.

However, I believe by 1943 or so, the Institute was again having trouble with the Government of India; this time not with the Ministry of Finance, but with the Ministry of Education. He told me about these difficulties again and I thought this time I might be able to help him a bit. That is how I happened to offer myself to become the President of the Indian Statistical Institute and to exercise a certain amount of entirely legitimate influence on the Education Ministry. We succeeded to some extent; and we secured the first grant for the Research and Training Section of a sum of Rs. 4 or Rs. 5 lakhs per year. We also, I think, laid down lines on which future negotiations would be carried on.

Ever since then I have been associated with the Institute as its President; and later on I have been able to take, perhaps in a somewhat ambiguous way, a useful part in develop-

* Transcription from magnetic tape-record.

ing the institution. As the Professor has told you, he is not quite sure whether I have been a help or a hindrance. I think these views can be reconciled. What actually happens is that I myself have been carrying out a slow but sure procedure of educating my own Ministry. It is no use my using the steam-roller in getting things done for the Institute. That would be only temporary. Ministers are not permanent and may be replaced at very short notice; and another Minister who would come in my place might not be prepared to use of steam-roller. There has been an orientation of the Finance Ministry itself. My pre-occupation has been to let Professor explain his difficulties to the officials of the Finance Ministry; and I believe he is slowly succeeding so that although at the moment the fruit is late in showing, nevertheless it will fall into his lap. There is a certain amount of irritation which is due to intermittent pressure which is a well-known scientific phenomenon. I think he would gradually get what he wants. There is no reason to be despondent. He himself is not despondent with the way the things are being done by the officials of the Ministry.

He has given us some idea about how the work of the Institute has been expanding. I think that is because the Institute has been like a river which has carved out a benevolent course for itself, fertilising the land through which it has run. It has not eroded anything, it is not a river that brings sorrow— it is a river which fertilises even when it overflows with brimful energy. It has sought out work for itself and the Institute has been selling its utilities.

Now that phase has passed; and it is fit and proper, with the advent of the Welfare State, that the Institute is now concentrating on selling its wares to the State itself, and that is by way of the National Sample Survey, not to speak of the National Income Committee, in the work of which the Institute has also played its part. He has also mentioned several other enquiries which the Institute has carried out for Commissions appointed by the Government, but he did not speak of the work that the Institute is doing in regard to an extended sampling of agricultural yields, the work that was taken over from the Indian Council of Agricultural Research and later became a part of the routine NSS programme. He has also not mentioned the establishment of a Central Statistical Organisation in Delhi in which he himself plays a notable part, as the Statistical Consultant of the Government. There is his whole individuality, so much so that it is very difficult to distinguish between the Professor and the Institute. He is the Consultant of Government, and I think the Central Statistical Organisation is getting very good help from him although he is giving it silently which is all to the good.

Now of all these lines of work, I believe, that of the National Sample Survey is of the greatest importance. He has not told you of the controversy in regard to the work of the NSS. There is a good deal of controversy about it, based on differing views of economists and statisticians. However, I am quite sure, although a layman myself but a close observer of both camps, that these differences can be reconciled. I myself have no doubt that we shall find a way out of these divergent views and arrive at some satisfactor arrangement.

I mention this point because experts themselves differ from which the layman gets confused. There is so much conflict in regard to Statistics. The reason is that almost everyone regards himself as a statistician. Every moment some statistics are produced which are not to the liking of some people or other; and then Statistics itself comes into

disrepute. This happens everywhere—in all walks of public life; and that is why I am saying that at least in expert hands there should be no disagreement on basic approaches, among these whose business is to collect facts and to interpret them. Then at least the lay public would be satisfied and interested in the use of Statistics. I am sure, those who have been using it for the formulation of policies would have a peaceful mind.

The field for the formulation of policies is very wide. It is at this stage we are faced with such problems as how is capital formed, how is investment taking place, the employment potential, and such other hundred and one problems which confront us in the spheres of both economics and finance. Therefore, we look wistfully to the statisticians and economists to show us the way, to give us the straw out of which our policies are to be formulated.

So far as economic research is concerned, the Planning Commission has a grant at its disposal and has also an expert committee to advise on the programme of economic research. But I do not believe adequate attention is being paid to the programming of statistical research. However, I believe it will come in the fulness of time, may be, we have to wait for one or two years for these things to happen. After the analysis of the results of the NSS 7th or 8th round have become available, and National Income reports have been completed, may be, statisticians would be able to sit together and in company with the economists to draw up a programme according to priorities.

There are very many regional and subject gaps in our statistical information. I think it is also recognised that there are gaps, in statistical organisation which may well be filled up. I do not think, having regard to the dimension of possible work that has to be undertaken there is any fear of commitment on my part as the President of the Institute or as the Finance Minister. If I make a shrewd guess as a Finance Minister, there need be no apprehension that sufficient money would not be forthcoming for a properly thought out programme of statistical investigations; and therefore, I think this subject deserves the serious attention of statisticians.

In this connexion I may perhaps draw your attention to the figure 150 which seems to be rather magical. You will have already noticed from what the Professor had mentioned that the number of trainees is 150; also, the budget which was Rs. 150 in the first year stands today to be 150 times 150.

Now I have an announcement to make which I think will encourage the statisticians in this task that I have set forth. The Government of India have decided that the Indian Statistical Institute should be developed as the focal centre for professional training and research on the same lines as higher technological institutes and be given powers to award diplomas of professional training and qualification; and selected officers from Ministries should be trained in statistical work in the Institute for a suitable period. The question of the Institute being given power to confer degrees would be considered later when the Institute is fully developed. However, I should say that within a measurable period this decision will be implemented and then the Institute will be, as it deserves to be, placed on a permanent footing, when justice will be done because this is the Institute which has established greater international reputation, as far as I am aware, than any other research institute in India; and therefore it is only right that it should receive the hall mark of recognition.

TWENTYSECOND ANNUAL REPORT : 1953-54

SPEECH BY PROFESSOR P. C. MAHALANOBIS

President, friends and colleagues,

Our friend Professor S. N. Bose has referred to the very small beginning of the Institute. This was exactly what was in my mind. It is about 22 years ago that the Institute was formally founded, and we are very happy that our President is here today on the Foundation Day. When we started, I think, I am correct in saying that in the year 1932 our total budget was Rs. 150. That was a small beginning. But we believed, from the very beginning, however small it was, that statistics was a necessity for our country. I was then a teacher of physics in the Presidency College (having done some mathematics and some physics). It was a very great man of our country, the late Brojendra Nath Seal, who impressed on me how badly India stood in need of statistics in the modern sense. Also, from the very beginning, it has not been an ivory tower or an institution of pure academic studies in which I and my colleagues have been interested.

In real life, continually a job has to be done. The only justification of statistics is that it can help in making good decisions for executive or administrative action or in scientific experiments Statistics has not got the glory of pure mathematics which exists in its own right. We statisticians have to justify ourselves by doing a job from time to time.

This is how the Institute has grown, by doing jobs. In course of doing jobs, one feature of the Institute has been its close integration of many activities. Even within these very walls, we can collect information, make experiments, analyse the data, and then even print and publish results without going out of our own grounds. Also, the Institute had to grow like something living by overcoming many obstacles. It has grown through the great contributions of not only the scientific workers but also of those who were not intellectual giants, and whose education perhaps did not extend beyond matriculation.

I remember today with gratitude the help we have received not only from the colleagues who are brilliant mathematicians and statisticians but also from mere humble people who have built up the Institute by devoted service. My mind goes back today to the late Sudhir Banerjee who started working with me long before the Institute was founded. The other day, about a month ago, we lost another of my young colleagues—Gayanath Adak, whom I first met while we were starting a survey on the weaving industry in a village 16 or 17 miles from Calcutta. The service he gave to the Institute was not that of a mathematician or a statistician, but which was of equal value in a different way.

This Institute does not rely on others to do what is needed. For example, we have rather a good building which you have seen, we have built it ourselves, that is, without any help from outside architects or engineers, and the chief credit goes to Shri Subodh Dasgupta who had passed only an Overseer's examination, and was not a trained engineer. I therefore remember today those also of my colleagues who have no scientific reputation, but who nevertheless helped in building up this Institute. We believe in cooperation and team work, and giving facilities to our workers to serve the country. This is the spirit in which we have worked.

I should now like to mention some of the recent projects. Since 1950 the Institute has been doing the statistical work of The National Sample Survey which is a most impor-

tant project for the whole country. During the year under review, at the desire of Government, the Institute also made some quick surveys in different fields. For example, a survey of refugee and rehabilitation work in West Bengal was carried out by the Institute. In the Fact Finding Committee appointed by the Government of India one of our colleagues Satyabrata Sen served as a member. We believe the survey carried out by the Institute has helped in making wise decisions. The Press Commission wanted a survey; the Institute undertook it. Unemployment is a big question, and we have started work on that. The Taxation Enquiry Commission required detailed information on the consumption of many commodities. We have nearly completed the work, and we hope to be able to give the Taxation Enquiry Commission much essential information about the economy of our country.

In these ways, we have helped the Government in collecting basic information for our country. In connection with the development of sample surveys, I am proud to mention the name of one of my colleagues, Debabrata Lahiri who is now in the front rank of specialists in the design of sample surveys. I have seen the statistical work in other countries. We have in India as good men as anywhere—perhaps sometimes even better. I may mention the names of such workers as Nimai Ghose, S. Raja Rao, or Shankar Sen.

We have also our own workshop of which I feel particularly proud, because Samar Mitra, a mathematician who is also an engineer, has built a small but modern high speed computing machine to solve linear equations in ten variables. It is of a new design evolved in the Institute. We are proud that we have built it ourselves. I believe, this is the first high speed computer which has been constructed in our country. This is the way we are proceeding.

I have spoken of our Project work; now on the Training side, we firmly believe in something like the training of a medical practitioner when attached to hospitals. We do not believe in abstract academic work. We admit a small number of trainees who came here to undergo a kind of apprenticeship work.

There is one new development to note, namely, Statistical Quality Control. It has taken a long time to make a beginning. I started almost 20 years ago. In 1947-48 Dr. Walter Shewhart, the originator of SQC, came to India at our invitation. Last year, the Institute helped actively in organising the short training courses which were given in Delhi, Calcutta, Bombay and Madras by an expert team from the United Nations. In September of this year, with the help of financial support from Government, we established a whole time SQC unit with Dr. (Miss) S. P. Vaswani as its head and R. G. Narasingham, B. K. Raja Rao as whole time workers. We hope this unit will give effective help to our industrialists. In this matter a good deal of drive came from our friend and honoured Vice-President, Sir Shri Ram.

We have got 35 acres of land at Giridih. We have started making crop estimation; and our students went there this year to participate in the actual crop-cutting work. At Giridih, I must mention Jiten Taluqdar, just a matriculate, who came here as a junior computer but has shown great initiative as the head of the Giridih branch.

In Delhi also we have got an office which maintains close contact with Government. There we have got Pitambar Pant, in exactly what capacity it is very difficult to define; and Probhat Sinha who with a small staff, is helping in a good deal of work of the Government of India. We have now much closer relations with the different Ministries.

We have got in Bombay an operating Branch under the effective charge of N. S. R. Sastry of the Reserve Bank of India. The Governor of the Reserve Bank of India (Sri B. Rama Rau) is present here—we have received from him a good deal of support.

Our friends will notice that our activities are multifarious. All told, our staff comes to more than 700; and the budget is now something like Rs. 26 or 27 lakhs. The Institute has become quite big—I sometimes think, perhaps, much too big. Too many new workers are coming in, and it is a difficult task to assimilate them quickly into the traditions of the Institute.

This is a short review of how the work is developing. I think we have invited all our old workers and many of them have come. We are celebrating to-day the anniversary of the first meeting on 17 December 1931 when it was decided to establish the Institute. The late Sir Rajendra Nath Mookerjee presided over this meeting and he was our first President. I remember with gratitude what he did for the Institute; he attended every meeting of the Council as long as he was alive. Without his help, we could not have done so much. We also remember other friends who have helped us.

There are developments in many directions for which we are thankful to our President in a different capacity, namely, as Minister of Finance. However, I have a little quarrel with him that he has not been exercising his own discretion and not looking into the Institute cases in his Ministry because he is our President. In the beginning we had a harder time. If some one else had been the Minster of Finance possibly, I could fight actively. However, the Ministry has been very kind and we are getting its cooperation in the way of quick clearance which is almost unprecedented in New Delhi.

I must also say a word about our Prime Minister who is taking continuing interest, and will visit the Institute tomorrow. He will be coming here unofficially. He has been here before and will come to see the work we are doing in the Institute.

I should like briefly to refer to the International Statistical Education Centre which was started here in 1950 to provide statistical training to persons coming from different countries of Asia. Each term is of six months' duration. This is the sixth term. We had started with a grant from the UNESCO, and the International Statistical Institute, but the Government of India also have been helping a good deal in the way of Colombo Plan Fellowships and more recently with earmarked grants. We have had uptil now 150 students of which about a hundred have come from outside India from 12 or 14 different countries. The sixth term is concluding in a few days, and I shall request our President to award Certificates to the trainees.

[This was followed by the award of Certificates to the trainees of the International Statistical Education Centre by Shri Chintaman Deshmukh.]

2. THE YEAR UNDER REVIEW : 1953-54

1. General Administration

1. The total number of members of the Institute at the end of the year was 156 inclusive of 21 new entrants. There were 3 General Meetings, inclusive of the Annual General meeting. The Council had 15 meetings during the year. (Names of the members of the Council are given in Appendix I).

2. Important amendments to the Memorandum of Association were made during the year (Appendix III); there were also certain modifications of the Rules of the Institute (Appendix IV) consequent on which persons who were interested in Statistics but could not be regular members of the Institute could be enrolled as seasonal and student members without right of voting at general meetings and with certain restricted privileges. The number of such seasonal and student memberships was 1 and 13 respectively at the end of the year.

3. The Institute suffered irreparable loss during the year in the death of several persons who were intimately connected with the Institute and had rendered valuable service to its cause :

(i) Shri Nalini Ranjan Sarkar was Vice-President for 8 years from 1934-35 to 1941-42; President for 3 years from 1942-43 to 1944-45, and again as Honorary Vice-President for 5 years from 1945-46 to 1949-50.

(ii) Shri A. H. Ghuznavi, Vice-President for 6 years from 1941-42 to 1946-47.

(iii) Dr. Shyamaprasad Mookerjee, Vice-President since 1935-36 until his death.

4. The Governing Body of the Research & Training School met three times during the year : on 7 July 1953 in New Delhi, on 15 December 1953 in Calcutta and on 11 March 1954 in New Delhi with Shri C. D. Deshmukh, President of the Institute in the chair on all three occasions. Shri A. C. Guha, Deputy Minister of Finance and Shri Pitambar Pant, Private Secretary to the Chairman, Planning Commission attended by special invitation at the first meeting. The second meeting was followed by a joint meeting with the Council. (Names of the members of the Governing Body are given in Appendix II).

5. As mentioned in the previous report, the Institute continued its policy of decentralised administration through a number of working committees. An Administration Committee, which had been set up earlier, was reconstituted in September 1953 and met frequently to discuss questions of policy and important administrative matters. The Technical Committee continued to function and met regularly. The House Committee was reconstituted in December 1953. Shri S. C. Sen, Joint Secretary, was in charge of general administration; and Shri N. C. Chakravarti, Joint Secretary, looked after the financial and committee work.

6. *Accommodation :* New extensions to the Institute building provided 7200 sq. feet of additional space over the 36,500 sq. ft. available at the beginning of the year. No provisions could be made for the hostels which continued to be housed in hired premises.

7. Calcutta Office : The main portion of the City office which has been located in the Presidency College since the inception of the Institute was shifted to 9B Esplanade East in December 1953, where 4500 sq. feet of space had been placed at the disposal of the

Institute by the Government of India. The computer's training classes were also later shifted to Esplanade Office in May 1954.

8. GIRIDIH OFFICE : There was considerable developmental work at Giridih. About 12 acres of the newly acquired land was reclaimed for cultivation and 2000 feet of 14 feet wide roadway have been laid on the property. About 6000 feet of barbed wire fencing have been erected round 35 acres of prepared land and protective measures against erosion have been taken. About 9 acres of land were brought under cultivation under a scheme of conducting agricultural experiments. Shri J. N. Taluqdar was in charge.

9. DELHI OFFICE : The office at Delhi continued to function in the residence of P. C. Mahalanobis as a vital link between the Institute and the Government of India. The office still suffers from limited space and a very small staff.

10. *Distribution of workers at different centres :* The following table shows the distribution of workers at Baranagar, Calcutta, Giridih, Delhi and Bombay as on 31 March 1954. Figures are also given for the Field Branch maintained under the direct control of the Institute for sample surveys and special enquiries.

centres	*workers & scholars*		*bearers*		*total*	
	1953	*1954*	*1953*	*1954*	*1953*	*1954*
Baranagar	338	455	84	101	422	556
Calcutta	32	10	14	6	36	16
Giridih	48	52	18	17	66	69
Delhi	4	8	2	2	6	10
Bombay SQC	—	4	—	1	—	5
Statistical Field Branch (including field staff)	422	529	118	127	530	656
	121	131	37	40	158	171
Total	543	660	155	167	688	827

11. *Changes in staff :*

(a) Dr. P. B. Patnaik joined in August 1953 as Professor in charge of the Research and Training School, on loan service from the Government of Madras during the period of leave of Dr. C. R. Rao who left India on 31st August 1953 to take up his assignment in the University of Illinois, U.S.A., as a Visiting Professor. Dr. (Miss) S. P. Vaswani, who was in charge of Statistical Quality Control at Ahmedabad Textile Industries Research Association, joined the Institute on 1 September 1953 as Head of the Statistical Quality Control Unit. Dr. G. Kallianpur joined the Research and Training School in August 1953. Sri S. J. Poti, an old worker of the Institute, rejoined in September 1953. Sri B. K. Raja Rao joined in October 1953 in the newly opened Statistical Quality Control Unit. Dr. Asoke Rudra joined the Research and Training School in November 1953 and Sri D. S. Kamat in January 1954 to work in the Electronics Laboratory. Sri Des Raj who came to the Institute as a Research Fellow last year, was appointed a regular member of the teaching staff in January 1954.

(b) Sri D. Basu left in June 1953 for higher studies and research in mathematical statistics for one year in the University of California with a U.S. scholarship and Fulbright travel aid. Dr. Ambika Ghosh left in January 1954 on study leave to work in the University of Manchester with a research scholarship. Dr. A. K. Gayen left in February 1954 to take up an appointment in the Indian Institute of Technology.

12. *Prizes :* It was decided that specially meritorious work which contributed to the advancement of the Institute should be suitably rewarded. Accordingly 36 workers were awarded cash prizes ranging from Rs. 200/- to Rs. 3,000/- for outstanding work and a total of Rs. 20,800/- was spent on this scheme (List of prize winners in Appendix XII).

13. The Institute suffered a great loss this year in the sudden and untimely death on 8 November 1953 of Sri Gayanath Adak, who was one of the oldest workers of the Institute, having served it for more than 17 years with great devotion. He was a resident worker, selfless in spirit, and always willing to be of service to others.

14. *Social and Welfare Section :* The expansion of the activities of the Institute and the consequent increase in staff necessitated a complete reorganisation of the social and welfare work. The Council requested Srimati Rani Mahalanobis, who is a life member of the Institute and who had been actively associated with the social and welfare work of the Institute from the very beginning, to take charge of the Section as its Honorary Director. She kindly agreed to undertake this responsibility and thoroughly reorganized the work.

(i) *Medical Unit :* There were many improvements in the medical unit at Baranagar. A small building was placed at its disposal, providing a reception room, an examination chamber, a dispensing room, an isolation room and 2 beds with necessary sanitary arrangements. The unit treated 5581 cases in the examination chamber, made 815 visits to the residences of workers, gave advice in 518 cases and served 5083 prescriptions worth Rs. 5,465 during the year. Its anti-malarial drive, so long confined to workers resident in the city was extended to the field workers also. A pilot survey of general health conditions of workers was undertaken.

The Medical Unit at Giridih served 1552 prescriptions and attended to 254 calls at workers' residences.

(ii) *I.S.I. Night School :* In the month of February 1954 a night school was opened for imparting education upto the School Final Standard to workers in the subordinate cadre and poor students who cannot afford to study in day schools. The present roll strength is 32 with three teachers.

(iii) *Workers Canteen :* The Canteen this year served the needs of more than 500 workers per day and provided tea and refreshments at reasonable rates. The canteen also served the subsidised tiffin to members of the Tiffin Club. The House Committee is looking after the management and is trying to make the canteen financially self supporting.

(iv) *Workers' Club :* The second year of existence of the Club was marked by an all round extension of its activities. The Club successfully organised an inter-departmental football league, a table tennis tournament, a carrom contest and an auction bridge competition, in addition to the annual sports meeting and a pleasure trip. It published the first number of its literary organ, *Lekhan*, on the occasion of the twentyfirst Anniversary Day of the Institute. It also held a social gathering with an interesting programme of vocal and instrumental music. A playlet staged by the workers of the Field Section on this occasion was greatly appreciated by the audience.

The Salboni Club at Giridih had, among other activities, arranged an excursion to the Topchanchi lake. It also organized flag hoisting ceremonies on the Independence Day and Republic Day anniversaries.

2. External Activities

1. Professor Mahalanobis continued to work as the Honorary Statistical Adviser to the Cabinet, Government of India, and spent a good deal of time in Delhi.

2. He was also engaged in other statistical activities which involved touring in India and abroad. After attending the 7th Session of the United Nations Statistical Commission (2–13 February 1953) in New York, he visited Cambridge, Mass. and Washington D.C. and had discussions with representatives of UN TAA, US TCA, Ford Foundation, National Bureau of Economic Research, US Bureau of Census and Massachusetts Institute of Technology. He spent a few weeks in London and later visited Cambridge, Oxford and Manchester and had discussions on statistical matter. He opened the discussion on 'Foundations of Statistics' on 17 April at the Symposium on Statistics arranged at the Federal Institute of Technology at Zurich. He made references to the sevenfold dialectic of Jaina logic in relation to the modern theory of probability which aroused much interest.

3. In August 1953 Professor Mahalanobis again visited the United Kingdom, Italy, Belgium and other countries in Europe to attend a number of scientific meetings and conferences. He delivered on 11 August 1953 a lecture on Technical Progress, Organization and Human Personality' at the triennial conference of the International Federation of University Women, in London. He attended the International Biometric Conference from 30 August to 2 September at Bellagio, Italy, and from 3 to 5 September the International Conference on Income and Wealth at Castel Gondolpho; and participated as the leader of the Indian delegation in the biennial session of the International Statistical Institute in Romo from 6 to 12 September, and returned to India on 16 September 1953. Srimati Rani Mahalanobis was with him during his visits to USA and Europe.

4. Professor Mahalanobis presided over the Second Joint Conference of Central and State Statisticians in New Delhi on 26–27 October, 1953 and the Joint Meeting of the Statistical Quality Control Committee of the CSIR and the Indian Standards Institution at Hyderabad in January 1954. In connection with statistical matters he visited Srinagar, Jammu & Kashmir in November 1953: Hyderabad, Bangalore, Trivandrum and Madras in January 1954 where he discussed various problems of coordination and improvement of statistical services. At Bangalore he met the members of the Statistical Quality Control group and discussed possibilities of establishing a whole time SQC Unit there. He presided over the last meeting of the National Insurance Committee on 14 February 1954 in New Delhi when the Committee signed their final report.

5. Professor Mahalanobis was leader of the Indian delegation at the Third Regional Conference of Statisticians jointly conducted by the Secretariat of the Economic Commission for Asia and the Far East and the Statistical Office of the United Nations which held its session in New Delhi from 1 to 11 March 1954.

6. Dr. C. R. Rao, Head of the Research and Training School and a member of the International Statistical Institute attended the biennial session of the International Statistical Institute in Rome in September 1953 on his way to USA where he served as a Visiting

Research Professor of Mathematical Statistics for one academic year in the University of Illinois at Urbana. He also gave lectures at the Universities of North Carolina, Chicago, Purdue etc., besides giving a full course at the summer session at the University of California. He attended a number of scientific conferences in U.S.A. and the International Mathematical Congress in Amsterdam in September 1954. He was elected a fellow of the National Institute of Sciences in January 1954.

7. Sri S. B. Sen who was in charge of the Projects Branch of the Institute attended the International Statistical Conferences at Rome in 1953 at which he presented a paper on the National Sample Survey. After the Conference he made a short trip to England and made contacts with many statisticians and economists.

8. Dr. (Miss) S. P. Vaswani shortly after joining the whole time SQC Unit, went to Rome in September 1953 to attend the International Statistical Conferences. She then visited England, Germany, Holland and Switzerland to study recent advances in Industrial Statistics and Quality Control.

9. Dr. P. B. Patnaik, Dr. G. Kallianpur, Dr. A. K. Gayen, Sri Des Raj, Sri A. Mathai, and Sri J. Roy of the RTS, Dr. S. P. Vaswani, and Sri B. K. Raja Rao of the SQC Unit and Sri D. B. Lahiri and Sri N. C. Ghosh of the NSS attended the Indian Science Congress at Hyderabad in January 1954 as delegates from the Institute. Dr. R. Vaidyanathaswamy and Sri M. S. Srinivasan attended the Conference of Indian Mathematical Society at Delhi in December 1953. Dr. (Miss) S. P. Vaswani and other members of the SQC Unit attended the All India Textile Conference in Bombay in March 1954.

10. Dr. C. R. Rao, Dr. P. B. Patnaik, Dr. R. Vaidyanathaswamy and Sri Des Raj and other members of the teaching staff served as members of the Board of Studies and/or Board of Examiners a member of Indian Universities.

3. Research and Training School

1. The transfer early in 1953 of the Research and Training School and the International Statistical Education Centre from Presidency College to the new building of the Institute at 203 Barrackpore Trunk Road helped greatly in a closer integration of the work of the two units. Closer association with the National Sample Survey (NSS) led to increased facilities for professional training in field work, large scale processing, analysis of data and machine tabulation.

3.1. Training Courses

1. *Two-Year Professional Course :* This course is provided for candidates who have already taken the Master's Degree in statistics, mathematics, or an allied subject. The programme of training was slightly modified to give more emphasis on training through applied work. The students participated in NSS and other project work, and also took up some research problems in the Project Branch. Five senior students and two research scholars conducted two series of seminars on Sample Surveys and Non-parametric Inference.

The senior students had a ten-day camp at the Giridih Branch of the Institute in November 1953 and conducted crop cutting experiments. They also had a two-week visit to Delhi in April 1954 where they visited the different statistical agencies in the Government

of India and attended special lectures by official experts organised by the Central Statistical Organisation. The students visited some villages to study methods of field investigation and got acquainted with the elements of the servicing to computers in the workshop of the Institute.

Sixteen students of the second year class appeared at and passed the final examination (list in Appendix X). The number of students promoted from the first year to the second year in July 1953 was 14; three other students who had a three-year B.Sc. Honours degree in Statistics were admitted directly into the second year class after passing a qualifying test. The number of students admitted into the first year was 16 of whom 3 dropped out before the end of the session. The name of the first and second year students are given in Appendix X.

Prizes and scholarships were awarded to several students on the results of the periodical examinations.

2. *Computer's Training Course :* Classes for the junior and senior courses, each of six months' duration were held in the City Office of the Institute. In the session, July to December 1953, there were 24 students in the junior section and 13 in the senior section during the session July to December 1953. In the session January to June 1954, the number of trainees were 25 and 16 respectively.

3. *Officers on Deputation :* Eight officers deputed by the Central or State Government departments or educational institutions were given training in the special fields in which they were interested (list in Appendix VIII).

4. *Hostels :* The two hostels for the students were full during the year. The general health of the inmates was satisfactory.

3.2. Theoretical and Applied Research

1. *Research Seminars :* Among the research seminars held during the year the following were the more important : Professor Mahalanobis on Estimating Crop-yields; Dr. R. Vaidyanathaswamy on Topological Groups; Dr. P. B. Patnaik on Unbiased Statistical Tests; and Dr. G. Kallianpur on Limit Theorems.

2. *Research Scholars :* E. M. Paul and H. N. Kamath continued as research scholars from last year. The following new research scholars were taken during the year : C. S. Ramakrishnan, K. S. Srikantan, V. Vikraman, G. Ramaswamy, M. S. Srinivasan and G. Ramachandran.

Mr. A. Kudo of the University of Tokyo came to the Institute in January 1953 as an advanced student on a fellowship.

3. *Theoretical Research :* The figures within brackets refer to the list of papers given in Appendix (VI); some of these are published papers, some to be published and others only preliminary reports.

i) *Sample Surveys* (1, 2, 3, 4, 5, 6, 7, 31, 32, 35, 40) : Various problems of multistage sampling designs were studied such as sampling with varying probabilities, precision of the components of variance, planning when there are a number of correlated variables, optimum allocation of sample sizes, and methods of estimation for different types of surveys.

ii) *Statistical Quality Control* (5, 8, 9, 33, 34) : Topics studied were construction of control charts when the population is significantly different from normal, and acceptance plans for inspection by gauging. Tables of control limits for individual observations when samples are small were published.

iii) *Crop Surveys* (15, 25, 29, 30) : It was shown that integral Geometry could be applied to the estimation of areas under crops, indicating also the order of boundary bias. The theoretical results were checked by actual field experiments conducted at Giridih. Results on sums of areas have also been obtained in a different way together with the variance of the estimates.

iv) *Distributions and tests* (20, 21, 24, 36, 38, 39, 41, 42, 48, 49, 55, 56) : Certain characterisations of the multivariate normal and gamma distributions were obtained. From distributions of non-central range, non-central t, and likelihood ratio in analysis of dispersion, the power functions of certain important tests were studied; experimental comparison was made of the power of various two-sample non-parametric tests. Tests for the equality of two Poisson variates, for out-liers in normal samples, and for independence of two sets of normal variates where a third set is fixed, were obtained. The distribution of the sample number in sequential tests has been studied for changing and truncated normal populations. A new approach to the planning of experiments when costs depend on outcome has been developed.

v) *Estimation* (34, 44) : It was shown that for estimating a scale parameter of a uniform distribution, the existence of a minimum variance estimator implies the existence of a sufficient statistic, and conversely.

vi) *Decision functions* (18, 19, 45, 47) : A property of the t-statistic from a standpoint different from that of Bahadur (1952) has been derived. In the problem of means of two populations, the effect of intra-correlation on the minimax properties was examined.

vii) *Time-series* (22, 50, 51, 52, 54) : Topics studied were a modification of the variate-difference method for determining the degree of the polynomial trend; method of deciding on the optimum model to fit to time-series from amongst periodic, auto-regressive and moving average models; and a new technique for searching for periodicities. Problems of goodness of fit and discrimination with respect to linear regression models have been considered.

viii) *Probability and measure theory* (11, 12, 13, 14, 16, 17) : Ergodic properties of the Brownian motion process and certain Markov processes were studied. Some theorems on sequence of sum of independent random variables have been proved. One of the papers deals with outer-measure in topological spaces.

ix) *Miscellaneous* (23, 46, 53, 57, 58, 59, 60, 61) : Some of the papers deal with purely mathematical results; one of them concerns the Radon-Nikodym theorem. Others are of an applied nature based on numerical data, such as analysis of absenticism, and analysis of time variations in cosmic ray intensities.

4. *Applied Research :*

i) *Crop estimation at Giridih :* The students of the Research and Training School, conducted a number of sampling experiments on crop estimation at Giridih in November 1953. Different operational methods of reducing the bias in small size circular cuts were investigated. An alternative method of crop estimation by successive halving of a crop-

plot-in stages and choosing one-half at random at each stage and harvesting the ultimate portion was also tried. The results were encouraging indicating need of further research.

ii) *Bengal Anthropometric Survey :* The work on Bengal Anthropometric Survey (1945) was continued. The primary material consists of measurements on each of 16 different physical characters of nearly 3,000 individuals classified in about 60 social groups scattered over the 28 districts of undivided Bengal. Preliminary scrutiny and correction of the raw data were completed and the correlation matrices were calculated.

iii) *Construction of an index of business activity in India :* Weights used in indices of business activity in India were so far derived on a subjective basis. Attempt is being made to derive the weights by Hotelling's principal component analysis. A large volume of data was collected on 18 series under the following categories :— mining and industrial production, financial operations, inland and foreign trade. The analysis of the data has started.

iv) *Optimum sampling scheme for estimating the crop acreage in a given village :* Work on an incomplete research project to investigate different modes of sampling (probability proportional to area, equal probability, ratio method etc.) for estimating the total acreage in a village under a given crop was taken up again. The data available gave complete enumeration of geographical areas and crop areas of plots in a number of randomly chosen villages representing each of the 13 districts of West Bengal, the particular crop being *aman* rice, and the year of enumeration being 1949. Some interesting tables comparing variances and biases of different estimators, as well as the loss of efficiency due to increasing size of clusters have been obtained. So far the findings are that the method used in the Institute, that of sampling with probability proportional to the geographical area of a plot, is superior to all the others considered. Nothing can however be said in a general way about the whole State until much more work is done.

v) *National Sample Survey :* A research study was undertaken on the efficiency of processing of the NSS data with a view to (a) set up standard times for different types of scrutiny operations, and to find the optimum method of combination of such operations on the NSS schedules, (b) study the frequencies of various types of mistakes corrected during scrutiny and trace their causes, (c) evolve suitable card designs for transferring information to punched cards, (d) obtain estimates of some of the important economic variates and the variances of these estimates including stage variances, and (e) conduct demographic and economic studies on the data available with the NSS.

3.3. Scientific Enquiries

The Research and Training School attended to a number of scientific enquiries from outside a list of which is given in Appendix VII. Some of the important problems handled are described below.

1. *Growth of fish :* Enquiries in this field relate to the utilisation of the length-weight relationship in three species of Indian carps for constructing a health index which would measure the comparative suitability of different methods of pisciculture.

2. *Biological value of diets :* The results of a feeding experiment on a number of rats to determine the biological value of different diets were analysed.

3. *Optimum dilution of insecticide :* The problem was to determine the optimum strength of the insecticide to give a certain kill earlier than the other strengths from the recorded number of insects killed every 2 hours for different dilutions of an insecticide.

4. *Variations in cosmic ray intensity :* The cosmic ray intensity at any particular place is affected by changes in meteorological and magnetic factors. The data collected at Ottawa have been analysed to check some of the current theories.

4. International Statistical Education Centre

1. The responsibility of maintaining the International Statistical Education Centre (ISEC) continued to be shared by the International Statistical Institute and the Indian Statistical Institute with the help of a Government of India grant of Rs. 58,000 made available through the Indian Statistical Institute. The Government of India also sanctioned in 1953 a grant of $9000 to the International Statistical Institute to provide teachers from abroad for the ISEC. The liaison work for the Centre with different countries was carried on as before from London by the Executive Officer of the Education Committee of the International Statistical Institute.

2. The year under review covered the fifth, sixth, and seventh terms of the ISEC. The fifth term opened on 12 January 1953 and terminated on 30 June 1953. Thirty trainees from seven countries attended this term distributed as follows : Burma 2, India 5, Indonesia 1, Nepal 1, Pakistan 13, Philippines 6, and Thailand 2; total 30.

3. The sixth term opened on 13 July 1953 and closed on 19 December 1953 and the distribution of participants was : Burma 2, Ceylon 1, India 7, Indonesia 3, Japan 2, Nepal 1, Pakistan 6, Philippines 3; total 25.

4. The seventh term opened on 11 January 1954 and was carried over to June. Participation was as follows : Burma 2, India 12, Indonesia 3, Nepal 1, Pakistan 1, Philippines 3, Viet Nam 2; total 24. The list of trainees who attended during 1953-54 is given in Appendix IX.

5. The Government of India made awards of Fellowships under the Colombo Plan to sixteen trainees of each of the fifth and the sixth terms carrying a living allowance of Rs. 380/- per month plus travel and other allowances, and Fellowships of the like amount to 12 trainees of the seventh term.

6. Instruction at the Centre was shared between the staff of the Indian Statistical Institute, other statisticians from within India and visiting teachers from abroad who came under the sponsorship of the Education Committee of the International Statistical Institute and the United Nations and its Specialised Agencies.

7. During the period April 1953–March 1954, a total of 1085 hours of teaching was provided. Out of this 1063 hours were spent in laboratory, project and field work and the balance of 622 hours on lectures on theory. Since the third term (January to June 1952), it has become a regular practice for the students of the Centre to carry out by themselves a sample survey or similar project each term. A road traffic survey in the fifth term and cropcutting experiments at Giridih during the sixth term were undertaken. Reports on the projects were prepared by the trainees and appeared in the ISEC Souvenir volumes.

8. The programme initiated in the third term with the collaboration of the Central Statistical Organisation, New Delhi, to give training in official statistics and statistical organisation has become a regular feature of the Centre. During each of the subsequent terms, the trainees spent about two weeks at Delhi, attending courses of lectures and visiting statistical offices. Visits to some of the important statistical offices in Bombay, Simla and Calcutta were also arranged.

9. *The ISEC Association* formed by the trainees functioned with a good deal of enthusiasm. A number of excursions to places of interest in and around Calcutta, Agra and Banaras were organised. A written constitution was formed and adopted for the Association. Souvenirs were printed and published at the end of each term.

5. Visiting Professors and Guest Teachers

1. Since 1938 the Indian Statistical Institute has been inviting distinguished scientists from abroad to come to the Institute as visiting professors. Such visits have not only been of considerable benefit to the Institute and its workers but have contributed to wider knowledge and appreciation of the work of the Institute outside India.

2. The Institute has in recent years been trying to develop closer contacts with the Indian universities and other statistical organizations by inviting their statisticians to visit the Institute to participate in the programme of teaching and research.

3. A list of visiting teachers is given below. The sponsorship is indicated by initials within brackets : (E.C.) for the Education Committee of the International Statistical Institute, (UN) for the United Nations and its Specialised Agencies.

(1) Dr. M. Masuyama, University of Tokyo, Japan : came again for the second time in October 1953 for about one year, gave a course of lectures on 'Graphical Methods of Estimation'; held seminars on 'Application of Integral Geometry to Areal Sampling Problems'; did some work for the Project Branch; and gave lectures at the ISEC.

(2) Professor T. Kitagawa, Mathematical Institute, Kyushu University, Japan : was at the Institute from 25 April to 12 August 1953; held a series of seminars on 'Design of Successive Sample Surveys' and on 'Successive Processes of Statistical Inferences'; also lectured at the ISEC on 'Historical development of statistics'.

(3) Professor Ch. Bettelheim, Applied School of Higher Studies, Paris : came in December 1953 for three months; held seminars on 'Economic Budgeting in France' and on 'Problems of Productivity of Labour'. He also lectured in the Bombay and Delhi Branches on 'Planning of Investments' and on 'Technological Progress and Economic Structure'. At Delhi, he had discussions on planning with economists and some members and officials of the Planning Commission.

(4) Mr. James Durbin, London School of Economics was in the Institute during September-December 1953; gave lectures at the ISEC, and also a course of lectures on 'Time Series' to the second year training students and held seminars on sampling techniques. (E.C. : ISEC).

(5) Professor N. Wiener, Massachussets Institute of Technology, USA : stayed at the Statistical Institute for about 10 days in January 1954 and gave seminar talks on 'Multiple Prediction and Causality'.

(6) PROFESSOR A. KAWAGUCHI, Hokkaido University, Japan : on his way back to Japan in April 1954, gave five lectures on the 'Theory of Areal Spaces' and 'Introduction to Integral Geometry'.

(7) PROFESSOR WARREN AMBROSE, Massachussets Institute of Technology; delivered a course of three lectures on 'Topological Groups and Group Algebra' in October, 1953.

(8) MR. C. K. DILWALI, UN Statistical Office was in the Institute in December 1953–January 1954; gave lectures on 'Punched Card Methods' to the ISEC and RTS students and also spoke on population census methods and problems. (UN : ISEC).

(9) PROFESSOR Q. M. HUSSAIN, University of Dacca : visited the Institute twice during the year to lecture in the sixth and seventh terms of the ISEC on 'Design of Experiments' and 'Correlation'. (EC : ISEC).

(10) DR. K. S. RAO, Bombay University : delivered six lectures on the 'D^2-statistic and its applications' in March 1954.

(11) PROFESSOR K. NAGABHUSHANAM, Andhra University : held three seminars in April 1954 on 'Economic Models'.

(12) DR. K. S. BANERJEE, West Bengal State Statistical Bureau : gave six lectures to the ISEC and the training students on 'the Construction of Cost of Living Index Numbers'.

(13) DR. P. V. KRISHNA IYER, Ministry of Defence, Government of India : delivered three lectures on 'Non-parametric Inferences' in July 1954.

(14) PROFESSOR S. K. EKAMBARAM, Mysore University : gave three lectures on 'Variable Inspection for Percent Defective' in December 1953.

(15) DR. N. MINAKSHISUNDARAM, Andhra University : spoke on 'Recent Trends in Mathematics'.

(16) MR. M. LIEBERMAN, Statistical Adviser to the Government of Burma : gave lectures on the 'Census in Burma' in February 1954. (UN : ISEC).

(17) DR. N. KEYFITZ, Dominion Bureau of Statistics, Canada, spoke on 'Statistical Organisation', in March 1953 & February 1954. (UN : ISEC).

(18) MR. AIDENOFF, UN Statistical Office gave lectures on 'Statistical Organisation and social accounting' in December 1953. (UN : ISEC).

(19) DR. C. P. G. J. SMIT, Regional Statistician, FAO, Bangkok, gave lectures on 'Agricultural Statistics' in March, April 1953. (FAO : ISEC).

(20) DR. A. R. SEN, Department of Economics and Statistics, Lucknow : held a seminar on 'Sampling without Replacement'.

(21) MR. A. S. WINDETT, UN Statistical Adviser in Burma, spoke on 'Statistical Organisation' in March 1954 (UN : ISEC).

4. *Other Guest Lecturers :* In addition to the names mentioned above the Institute was fortunate in having other distinguished guests who visited the Institute and gave lectures or participated in scientific discussions. Among them were Professor P. M. S. Blackett, F.R.S., N.L., of the University of London who gave a lecture on 'Operational Research'; Professor F. G. M. Stratton, F.R.S., of the University of Cambridge who gave a lecture on 'Structure of the Universe'; Madame Karnvauchova of U.S.S.R. who spoke on 'Agricultural Economics and Development in U.S.S.R.'; Dr. S. G. Mergelian who gave a lecture on 'Soviet Mathematical Development'. Dr. F. Yates, F.R.S., of Rothamsted

Experimental Station, U.K., Dr. Ernst Boris Chain, F.R.S., N.L. of the Institute of Micro-Biology in Rome, Mr. I. H. Abdel-Rahman, Professor of Astrophysics, Cairo, Egypt; Dr. Arthur Compton, D.Sc., N.L., President of the Washington University, St. Louis, Missourie, U.S.A., participated in scientific discussions.

Professional Examinations

1. During the year one candidate registered himself for admission to the *Associateship* of the Indian Statistical Institute.

2. The *Statistician's Diploma Examination* was held in August 1953 at Bombay, Calcutta, Delhi, Madras, Poona and Lucknow. Eightyfour candidates registered for the examination in one or more papers, of whom 61 took the examination and 37 passed.

3. The *Computer's Certificate Examination*, Part I was held in July 1953 at Calcutta, Giridh, Poona and Madras. Out of 127 candidates who registered themselves for different sections of the examination 114 appeared and 48 passed.

4. *The Statistical Field Survey Examinations* (Junior and Senior) were also held in June 1953 at Calcutta. Fifteen candidates registered themselves for different papers of whom 13 appeared and 7 passed.

The names of the successful candidates in the examinations are given in Appendix XI.

5. *Recognition of Certificates & Diplomas :* The question of recognition of the Statistician's Certificate awarded after two years' study, the Statistician's Diploma, and the Computer's and the Field Survey Certificates for purposes of public appointments was considered at a joint meeting of the Governing Body of the Research and Training School and the Council of the Institute held on 15 December 1953, and a representation has been submitted to the Ministry of Education, Government of India.

7. Project Work

7.1 National Sample Survey and Associated Projects

1. The National Sample Survey which commenced in 1950-51 had completed five rounds of the survey by the beginning of the year under review. The Institute is in charge of the statistical portion of the work while the Field Branch is working under the direct control of the Ministry of Finance. The Institute submitted several reports out of which the following were published by the Government of India this year.

(i) Report Number 2 : Tables with Notes on the Second Round (April-June 1951);

(ii) Report Number 3 : Tables with Notes on the Third Round (August-November 1951);

(iii) Report Number 4 : Special Report on the Survey of Persons in the Live Register of the Delhi Employment Exchange;

(iv) Report Number 5 : Technical Paper on Some Aspects of the Development of the Sample Design.

2. The work of the National Sample Survey involved consultations and discussions with other bodies both in the Central and the State Governments in organisational as well as technical aspects of the survey. The Institute was also called upon to tender advice

in connection with the collection of data on behalf of some State Governments and certain *ad hoc* agencies of the Government of India. Thus, there was a discussion with the representatives of the Bombay Government about the feasibility of coordinating the work of the Government with that of the N.S.S. Again, the Institute sent a representative to a conference arranged by the Government of Orissa in connection with the Orissa Sample Survey of acreage and outturn of principal crops. There was also a conference at the Institute of the representatives of Central and State Governments in connection with planning of a survey to meet the requirements of the Planning Commission and the F.A.O. programme of World Census of Agricultural Holdings.

3. During the year two main rounds of the National Sample Survey were conducted namely the sixth and the seventh. The subject coverage of these surveys was of the same socio-economic nature as in earlier rounds. Special surveys on employment and unemployment were also conducted in Delhi, Calcutta and other towns with population 50,000 and above.

4. *Sixth Round of the National Sample Survey:* The geographical coverage was the same as in previous rounds, namely, the Indian Union excluding Jammu and Kashmir, and Andaman and Nicobar Islands. The subject coverage included the usual data on consumer expenditure, household enterprises, trade, transport, and profession and services, non-household manufacturing enterprise employing less than 10 with power or less than 20 without power (which are not covered by Indian Factories Act 1948), and barter exchanges and consumption of home grown articles. Some general information relating to villages under survey were also collected as in earlier rounds—such as retail and wholesale prices, communication facilities, nature of non-agricultural activities, nature and extent of cooperative institutions. Land utilisation survey by direct observation of fields was continued during this round mainly for the training of investigators and methodological experimentation. A special feature of this round was the inclusion of certain items of information relating to habits of newsreading and readers' preferences needed by the Press Commission, Government of India.

5. The survey was carried out during the period May 1953 to August 1953. The reference period for most of the consumer expenditure items was seven days ending on the day preceding the date of enquiry; for other items (like services and durable goods) it was 30 days ending on the day preceding the date of enquiry.

6. The sampling design for the rural sector was the same as that of the fourth round i.e., a stratified three-stage sampling scheme. Tehsils, thanas or in some cases, police stations were taken as the first stage units, villages as the second stage units, and households as the third stage units. There were 240 strata in all: two first stage units were chosen from each stratum; and two second stage units from each first stage unit. Within each second stage unit a pre-assigned fraction of households were taken for the consumer expenditure items and a fixed number for the household enterprise items.

7. In the urban sector, each of the four big cities, namely, Bombay, Calcutta, Delhi and Madras formed four strata. The other towns were classified into four other strata depending on the population size. The towns in each of these four strata were further stratified according to four population zones namely, North & North West India, East India, Central India, South & West India. The sampling design adopted was a three stage scheme except in the case of the four big cities where only a two stage scheme was used. In the

big cities the first stage units were blocks of households, and second stage units the households. In the other case the first stage units were the towns, the second stage units the block, and third stage units the households. Sixtysix blocks in all from cities and 49 towns from other strata were included.

8. The first and second stage units in both urban and rural sectors were chosen with probability proportional to population and with replacement.

9. The tables required by the Press Commission were furnished in September 1953, but the bulk of the data collected in the round are in the stages of processing and tabulation.

10. *Seventh Round of the National Sample Survey :* This round of the survey was similar to that of the sixth round in so far as its geographical and subject coverage and sampling design are concerned, except that the items of information collected for the Press Commission were not included in this round. A new item collected in this survey was the opinion of households as to changes in acreages and outturn of rice during the current year compared to the preceding year. Other new items were information on employment and unemployment of the members of the households; births, marriages and deaths of the households during the year preceding the date of survey; sickness in the households during the month preceding the date of survey; loans, savings, transfers and assets; and housing condition.

11. This survey was carried out during November 1953 to March 1954. The villages in the rural sector and blocks in the urban sector were divided into two inter-penetrating samples and each sample was surveyed by an independent party of workers. Arrangements were made this time for scrutiny of schedules at the field stage itself by a batch of specially trained field inspectors.

12. Four consecutive progressive estimates of the percentage of opinions on outturn of rice were prepared and submitted to the Ministry of Food and Agriculture for immediate use. The bulk of the data of this round is still in the processing stage.

13. *Calcutta Employment Survey :* This survey was conducted at the instance of the Planning Commission in the municipal area of Calcutta city during September to November 1953. The subject coverage included information on the employment position, educational and technical attainments, economic and industrial status, details of gainfully occupied persons at two time-points, namely on the date of survey and a year ago. A stratified two stage sampling design was adopted. Tabulation of a part of the material has been completed so as to offer an independent estimate. A draft preliminary report was submitted to Government.

14. *Urban Employment Survey :* A quick urban employment survey was conducted in September 1953 in 23 out of 49 towns (excluding cities) included in the sample for the sixth round of the NSS. These 23 towns belong to the two largest population size classes. The subject coverage was broadly the same as for the employment survey in Calcutta.

15. *Sample Survey of Manufacturing Industries :* The sample survey of manufacturing industries for the reference period 1949 and 1950 was undertaken by the Directorate of Industrial Statistics, Government of India. The sample survey of manufacturing industries with 1951 as the reference period was transferred to NSS, and was conducted

in 1952-53. The survey of manufacturing industries has been continued this year with the year 1952 and the financial year 1952-53 as reference periods. The investigations started in September 1953 and was almost completed by March 1954. About 3,000 sample establishments were selected according to a stratified sampling design, the establishments being allocated to the different industry types by taking into account the volume of employment and variability of gross output.

16. *Crop Survey in West Bengal : autumn season :* A sample survey for estimating the crop acreage and outturn of jute and *aus* paddy crops was carried out in West Bengal (excluding the hilly tracts of Darjeeling and the forest areas of the Sundarbans). The design for the area survey conformed to stratified two-stage sampling with small village unions as first stage units and clusters of fields as second stage units. Six hundred primary units and ten second stage units per primary unit were taken.

17. For the yield survey, a similar sampling design was adopted but with the inclusion of two more stages of sampling, the ultimate unit being a circular cut of 100 sq. ft. The survey was carried out during the period July to October 1953 and the final estimates were ready by November 1953.

18. It was found that the estimate of area under jute and *aus* paddy could be built up with a margin of 3.6 and 3.2 per cent of sampling error respectively. The estimate of area under jute was found to be 27.2 per cent less and that of *aus* paddy 32.9 per cent more than the corresponding estimates for the last year. The production of jute was 25.2 per cent less and that of the *aus* paddy 54.3 per cent higher than the corresponding estimates for last year.

19. *Crop survey in West Bengal : winter season :* A sample survey for area and yield of (winter) paddy was carried out in West Bengal on similar lines as during the autumn season. A new method of eliminating border bias in cuts was tried, namely, of taking yield from border plants separately and adding half of it to the yield of the cut.

20. The survey was carried out during the period October 1953 to January 1954 and the final estimates were ready by February 1954. About 53 investigators were engaged for the collection of data during this survey. The estimates of area under winter paddy were based on 599 unions and 5909 clusters of 40 plots each. The yield estimates were based on 225 circular cuts of 5'–7½ inches radius.

21. The area under *aman* paddy was estimated with sampling error of 1.6 per cent, and the estimated area was found to be 2.2 per cent larger than last year; and the production of *aman* clean rice was 49.9 per cent higher than last year's figure.

22. *Special Studies :* Some special studies on a small scale were carried out by the field staff of the Institute to ascertain the most suitable reference period (day, week, fortnight and month) prior to the date of survey for items of consumption in household enquiries. The data are being analysed.

7.2. Other Projects and Applied Studies

1. *Survey of the refugee families at Bombay :* A sample survey was conducted during the months August to November 1953 at the request of the Ministry of Rehabilitation to ascertain the socio-economic condition of refugee families residing in the State of Bombay. A sample of about 3000 refugee households was drawn in two sub-samples from the Government colonies as well as from other places. A report was submitted to Government.

2. *Studies on sampling methods in population census based on the 1941 census enumeration slips of Hazaribagh, Bihar :* Experimental studies on the methods of sampling in population census (mentioned in last year's report) were continued during the year under review. By extracting 120 systematic samples of individual census slips from a tract containing roughly 7,00,000 slips, the efficiencies of systematic samples in building up some of the population tables were investigated. This is being pursued further. Also, the efficiency of the village as the sampling unit in respect of two important aspects of the population, viz., the distributions by (1) age-sex-civil condition and (2) sex-means of livelihood-dependency status, is being investigated.

3. *Survey of persons in the live register of the Delhi Employment Exchange :* A random sample of 800 registrants were chosen from the registers of Delhi Employment Exchange after suitable stratification and relevant data for a study of employment position during the period of survey and a year ago was collected by household enquiry. The subject coverage included demographic and employment details as on date of survey, during the month ended on the date of survey a year ago and history of past employment and willingness to work. The survey was done during a period of one month ended last week of September 1931. A report on this survey was published as 'The National Sample Survey Report Number 4' by the Ministry of Finance, Government of India.

4. *A study on the standardisation of the size of ready-made garments :* A request was received in May 1953 from the Director General of Postal Services, for advice in designing standard garments for their inferior staff; and a pilot survey was undertaken on a very small scale. A set of standard-size garments were procured from a reputed stockist of ready-made garments. These garments were tried on 130 Institute workers and the minimum adjustments needed for each in order to have an exact fit were noted independently by two different tailors. Correlations were studied on height, weight, chest and waist-round measurements of the 130 workers and on similar data for about 3000 individuals in the postal staff. It was found that height and weight (which can be easily ascertained) should be adequate for prescribing the specification of garments.

5. *Special experiments on jute :* (a) *Prediction of dry fibre from auxiliary characters :* Crop-cutting experiments on jute were conducted in August at three centres in West Dinajpur and 24-Parganas in West Bengal. One object was to study very small cuts of radius 1' compensated for the border bias. The compensation was found to be effective in the case of both paddy and jute.

Measurements were taken of a number of physical characters of the jute plant; and it was found that the correlation with the yield of dry fibre were generally high indicating possibilities of using the double sampling technique of taking a large sample for the physical characters and only a small sample for the yield.

(b) *Retting experiments for the extraction of dry fibre from jute plants :* Retting of jute according to normal practice is done by immersing the green plants under water for 15 or 20 days. It is often extremely difficult to find a suitable tank where the sample plants could be steeped and leave them to the care of a local man. Besides, it is difficult for an investigator on the move to come back at the right moment when retting is completed in order to get the jute fibre extracted, washed, and dried.

The present experiments consisted of peeling out the bark from the jute plants harvested in the form of circular cuts of one foot located at random, carrying the bark to

a central station and extracting the fibre in two ways (1) by steeping and (2) by a chemical process. These two processes were used on sub-samples of the same individual plants chosen at random. The variability of the ratio of extracted dry fibre to weight of bark or to weight of plant was found to be considerable. The chemical process on the whole gave a higher yield. However, it is obvious that the superior chemical process can be used on samples only after the process has come into general use.

6. *Experimental sampling :* Model sampling experiments were started to study the properties of perfectly patterned linear fields.

7. *Family budget enquiry at Giridih :* Information is being collected about quantities of daily consumption of major food items in Giridih from 1 June 1952 in both urban and rural areas. The data are collected by a house to house enquiry, supplemented by actual weighing of a sub-sample of days in each household. The survey is intended to be continued for a number of years.

8. *Survey of bullock-utilisation at Giridih :* An enquiry to ascertain the nature and extent of the utilisation of bullock labour was taken up in the rural areas near Giridih since June 1953. This enquiry is expected to throw some light on the seasonal patterns of 'idle-bullock-hours'.

9. *Calcutta health survey :* A pilot survey was conducted in Ward No. 23 in South Calcutta to collect basic information regarding the incidence of disease, types of treatment availed of, the cost of medical consultation and medicine during a period of 12 months.

7.3. Operational Research Unit

1. Operational Research is a technique of relatively recent origin. Nevertheless its importance in studying the physical aspects of problems connected with planning was recognised by the Government of India in sanctioning a grant of Rs. 40,000 in November 1953 for organising on an experimental basis, operational research on problems connected with planning. Accordingly an Operational Research Unit was formed under the direct technical guidance of Professor P. C. Mahalanobis. The work is being done in collaboration with the Central Statistical Office, the National Sample Survey and in contact with the Planning Commission.

2. Experimental work was started with the assistance of a small unit of investigators and field studies on an exploratory basis were undertaken at Faridabad and Palwal, under the leadership of Pitambar Pant (Private Secretary to the Chairman, Planning Commission) who is closely associated with the work of the Institute.

8. Statistical Quality Control

1. A whole time SQC unit on the lines recommended by the CSIR Statistical Quality Control Committee was set up in the Institute from 1 September 1953 with the help of an earmarked grant from the Government of India.

2. At the request of the Indian Statistical Institute the Government of India agreed to the setting up of the SQC Policy Advisory Committee with Shri C. D. Deshmukh (Finance Minister) as Chairman and Shri K. C. Neogy (Member, Planning Commission) Sir Shri Ram, Shri G. D. Birla, Shri Kasturbhai Lalbhai, Dr. S. S. Bhatnagar, Dr. Lal C.

Verman, Shri H. H. Keil, Shri M. G. Kotibhaskar, Shri S. C. Jain and Professor P. C. Mahalanobis as members and Shri Pitambar Pant as Secretary, to advise on the policy to be followed in promoting SQC allied work.

3. The first meeting of the Policy Advisory Committee was held on the 30th March 1954 and the second on the 27th August 1954. Though the second meeting of the Committee was held after the close of the Institute's official year a complete summary of the recommendations and actions taken on the basis of both the meetings is given below.

4. The Committee recommended that the SQC Unit now located in Bombay should continue to be stationed there for at least one year. Arrangements were made accordingly and the staff was increased from three to five from September 1954.

5. A Sub-Committee consisting of the Finance Minister as Chairman and Sir Shri Ram, Shri G. D. Birla and Professor P. C. Mahalanobis as members with Shri Pitambar Pant as Secretary was appointed at the first meeting of the SQC Policy Advisory Committee to recommend the scale of contribution to be paid by industrial concerns for the services of the SQC Units. This Sub-Committee met in Delhi on 21 May 1954; and on the basis of the report of this Sub-Committee the scales of contribution shown in Appendix V were recommended by the Police Advisory Committee on 27 August 1954 and later accepted by this Institute.

6. It was decided that the workers of SQC Unit should function as full time employees and it was not advisable, at this stage, to permit them to accept fees for consultation etc., from industry.

7. The industries to be given priority should be textiles, engineering, and chemicals but SQC Units can offer assistance to other industries provided there were good possibilities of successful applications.

8. The Committee recommended that two more SQC Units, each comprising from three to five whole-time SQC statisticians, should be organized as soon as possible for work in other centres; and another Unit is to be established primarily for Government enterprises. Accordingly one SQC Unit with three whole time statisticians was established on 1 September 1954 to work in Bangalore in collaboration with the Quality Control Association, Bangalore. Also two SQC statisticians were appointed from September 1954 to work in Calcutta.

9. Professor Mahalanobis was requested to secure the services of three or four SQC experts from abroad to help the SQC Units as consultants; and an earmarked grant of Rupees one lakh was subsequently sanctioned by the Government of India for this purpose. Arrangements were made for Dr. W. A. Shewhart, the founder of the modern SQC movement, to come to India in October on a visit of three months. Mr. G. Taguchi of Japan, Quality Control Engineer, Electrical Communication Laboratory of Japan, Telephone and Telegraph Public Corporation, who has wide experience of SQC work arrived in Calcutta on 2 September 1954.

10. On the recommendation of the Committee a central office to act as a clearing centre for SQC work was established in May 1954 as a part of the office of the Indian Statistical Institute in Delhi.

11. *Work of the SQC Unit in Bombay :* Dr. (Miss) S. P. Vaswani was in charge of the Unit with B. K. Raja Rao and R. G. Narasimhan as members. Soon after the formation of the Unit in September 1953 some preliminary work was started in the punching section

in the Institute in Calcutta, but it was decided a little later, to locate the Unit in Bombay in the first instance where the Unit participated in a training course in November 1953 In Bombay, the Unit is being assisted by two members of the staff of the Board of Management for Quality Control.

12. The activities of the SQC Unit at Bombay consisted of (1) training in SQC techniques; (2) in-factory work and consultation; and (3) promotion of SQC. It conducted a course on control chart methods from December 1953 to February 1954. Of the 42 trainees drawn from textiles, oil, fan, canning and cycle industries and university students 39 were considered eligible for the award of certificates. Later, advanced training was imparted to a few selected trainees from this batch. Sri R. G. Narasimhan of the SQC Unit was deputed to help the Bangalore Quality Control Association in their 10 day training course in the month of May.

13. In-factory and consultation work was started in January, 1954 and regular visits were made to seven factories and introductory visits to eight textile and oil mills in Bombay. Engineers and chemists from six other factories have consulted the members of the Unit. A number of promotional talks were given by members of the SQC Unit in and around Bombay between 5 February and 6 May 1954. The limit is also preparing a literature index in SQC.

9. Service Units

9.1. Machine Tabulation Section

1. There was considerable all round expansion in the machine tabulation section. The number of key-punch operators in the central punching unit at Baranagar increased from 21 to 40; and auxiliary units with a total strength of 45 opened in Calcutta and Giridih. With the installation of one additional tabulator, one reproducing summary-punch, two sorters and one calculating punch during the year the equipment at the end of the year consisted of 95 punchers and verifiers, 5 sorters, 4 tabulators, 4 reproducers, 1 collator, 2 calculating punches and 1 electronic statistical machine of the Hollerith type. Even then, for a number of months, the machine unit had to work in two shifts to cope with the work. The installation of two tabulating units of the Powers-Samas system with necessary auxiliary machine completed and would soon supply additional capacity.

2. The work audit group responsible for accuracy in punching work, the scrutiny group in charge of checking tabulation work, and card store which files and preserves punched cards also had to be simultaneously expanded. In-service training was organised and training was given in punching and machine operation.

3. The number of Hollerith cards used during the year was 54.83 lakhs of which about 80% was in connexion with NSS work. Card-passages were as follows. Sorters: 965 lakhs; tabulators: 70 lakhs; reproducers: 52 lakhs; calculating punches: 18 lakhs; collator: 64 lakhs; electronic machine: 99 lakhs; hand punches: 33 lakhs and hand verifiers: 32 lakhs.

9.2. Library

1. The central library was located at Baranagar. The service period of the reference section was extended up to 8-30 p.m. on week days and 6-30 p.m. on Saturdays. A service branch at Giridih was maintained as in previous years. The issue centre at the Presidency College was converted into a service branch for the convenience of members and students who reside in the city.

2. *Acquisitions :* The following publications were acquired during the year.

i) *Books :* 1324 volumes (against 949 last year) of which 107 were received as gifts from scientists, learned societies, and governments of various countries and international organisations.

ii) *Periodicals :* 893 periodicals and annuals (against 780 last year) of which 202 were subscribed, 384 were received in exchange and 307 were gifts from governments and scientific and other organisations in different parts of the world.

The library subscribed 29 new journals; made exchange arrangements with 27 foreign and 7 Indian journals; and was placed in the complimentary mailing lists of 7 foreign (Brazil-2, Pakistan-2, Panama-1, Poland-2) and 40 Indian agencies (in addition to 168 agencies with whom similar arrangements are already in existence). The library received an anonymous donation of 125 dollars from U.S.A. for the second consecutive year for the purchase of 'Current Digest of the Soviet Press' which was thankfully accepted.

3. *Official publications :* A circular was issued by the Ministry of Finance to all Ministries and Departments of the Government of India requesting free supply to the Institute of their respective publications to the Institute. Another circular from the Registrar General of India directed the State Census Commissioners to supply to the Institute free copies of all 1951 Census publications including district hand-books. The library received a large number of publications in response to the above circulars.

4. *Special materials :* A microfilm copy of Buchanon Hamilton's monumental work known as 'Buchanon Hamilton Collection' on the economic survey of India from 1807 to 1814 in the early years of the nineteenth century was prepared at the cost of the Institute from the India House Library in London. Microfilm copies were received as gifts of the unpublished works of the late Lewis F. Richardson on 'Statistics of Deadly Quarrels' and 'Arms and Insecurity'.

5. *Bibliographical services :* The library continued to issue a weekly list of selected periodicals received in the library, the monthly bulletin of new acquisitions, a quarterly index to current periodicals and a news letter.

6. *Enquiries and aids :* The library prepared a scheme of classification for the indexing and filing of the development schemes in the First Five Year Plan to suit the needs of the Planning Commission. About 3000 cards representing various schemes from the different States were also typed and classified according to the new scheme.

7. *Service and circulation :* The number of library members increased from 510 to 599. The total number of books, journals and other materials served was 20,606 of which 4,842 were issued from the lending section and 15,764 from the reference section (including overnight loans). The proportion of unfulfilled requests again registered a slight fall to about 7% (from 8% in the previous year) of the total requests received.

8. *Circulating library (general literature) :* There were new acquisitions of 470 Bengali, 105 English, 29 Oriya, and 21 Hindi books bringing the total to 5,225 volume . There were frequent rotation of stocks between the branches of the library. The number of books issued from Baranagar, Calcutta, and Giridih were 15,088, 1728 and 2558 respectively with a total of 19,374 against 10,267 last year.

9. *Records Unit :* The Records Unit which had been set up for the systematic arrangements and preservation of the large volume of maps and documentary material

collected in the course of statistical surveys conducted by the Institute arranged, classified and card-indexed 2,280 project files during the year bringing the total number of project files for reference to 3,049. The number of map-sheets handled during the processing was 2,24,762.

10. *Photographic Section :* The Library and Projects Branch made increasing use of microfilms and photocopies. About 2,600 exposures, 3,250 photoprints, 1,700 photo copies of maps, charts, documents etc., and 2,200 bromide enlargements from microfilms were made. The section also took about 1,050 photographs of different types and a total of about 1800 ft. of motion pictures on crop-cutting experiments, practical training in field work and functions at the Institute.

9.3. Electronics Laboratory & Workshop

1. *Electronics Laboratory :* One of the important activities of the Laboratory was the construction of an electrical analogue computing machine for solving linear equations with ten variables. The machine is based on an iteration method of solving linear equations; and can give the value of the largest latent root of the matrix. The construction of another larger and fully automatic machine to solve linear equation on this iteration method is in progress.

2. Research and development work began in January 1954 to construct an Electronic Digital Computer using a magnetic drum as high speed memory unit. Preliminary work was also started on the construction of auxiliary electronic equipment, stabilised power supplies, valve volt meter, basic two state device etc.

3. The Laboratory also served and maintained general electronic and other equipment in use in the Institute such as magnetic tape recording units, public address system, wireless inter-communication sets, 16 mm. cine-projector, epidiascope, etc.

Workshop : Besides routine repair and servicing work (including 474 cases of repairs of calculating machines) the workshop continued the developmental work on the manufacture of manual calculating machines. The numerous press tools necessary for the manufacture of such machines were constructed and components for a proto-type machine were fabricated. A few more machine tools including lathes, rivetting, drilling and grinding machines, and presses were added this year.

10. The Branches

10.1. Bombay Branch

1. *Local Council :* The following gentlemen were elected office bearers of the Branch for the year 1953-54 : *President :* Shri V. L. Mehta; *Vice-Presidents :* Professor C. N. Vakil, Shri R. G. Saraiya, Shri L. S. Vaidyanathan and Dr. N. S. R. Sastry; *Joint Secretaries :* Dr. K. S. Rao and Shri K. C. Cheriyan; *Treasurer :* Dr. D. T. Lakdawala. *Members of the Council :* Dr. R. L. N. Iyengar, Shri H. T. Parekh, Shri A. S. Palekar, Prof. M. C. Chakravarti and Shri V. V. Divatia. Three meetings of the Council were held during the year.

2. *National Sample Survey :* As in previous years, the Bombay Branch was in charge of the field work of the National Sample Survey in Bombay City. The sixth and

seventh rounds of the survey were completed; and the number of investigators was increased from 4 to 5 during the seventh round.

3. *Survey of industrial establishments :* A scheme for a sample survey of small-scale industrial establishments in Bombay City was prepared by the Bombay Branch and a grant of Rs. 10,000 was sanctioned for this purpose by the Council. The detailed design was prepared by Shri V. V. Divatia in consultation with the technical staff of the NSS and was approved by the Local Council of the Branch. The staff consists of one inspector and three investigators working under the supervisor in charge of the NSS work. The sample consists of 600 establishments from which information would be collected every quarter. The field work for the first quarter started from the first week of February 1954.

4. *Quality Control :* The study group which was formed after the termination of the UN TAA training course at Bombay in 1952-53 has been holding meetings on the last Saturdays of every month; so far ten speakers have addressed these meetings. A training course in Statistical Quality Control was organized by the Board of Management for Quality Control this year also. Since January 1954 Shri S. S. Dvivedi and Shri S. J. Mehta were working in close collaboration with the whole time SQC Unit stationed at Bombay.

5. *Institute Examinations :* The Branch conducted Statistician's Diploma Examination in Bombay in August 1953; in all 14 candidates appeared from this centre.

6. *Other Activities :* Dr. James Durbin, Reader in Statistics, University of London and Visiting Professor, in the Indian Statistical Institute, gave a lecture on 'Sampling with unequal probabilities' in December 1953. Professor Charles Bettelheim of Paris, Visiting Professor in the Institute, was in Bombay during the second week of January 1954 and delivered a lecture on 'Economic development and social structure'; and also had discussions on 'economic budgeting and planning of investment'.

Shri S. C. Sen, Joint Secretary, Indian Statistical Institute, Calcutta visited the Bombay Branch in February 1954 and met the members of the Council and the employees of all the units of the Branch.

10.2. Delhi Branch

1. The Delhi Branch of the Institute unfortunately had ceased to function for about eight years. Dr. G. R. Seth (who was the Secretary during this period) called a meeting of the old members of the Branch and present members of the Institute residing at Delhi on 5 September 1953 at which it was decided to revive the activities of the Branch. The Council of the Institute welcomed this move and agreed to give every possible assistance to the Branch through the Delhi Office of the Institute.

STATEMENT OF ACCOUNTS

Indian Statistical Institute: Receipts & Payments Account for the year ending 31 March 1954

To Receipts	Rs.	As.	P.	Rs.	As.	P.	*By Payments*	Rs.	As.	P.	Rs.	As.	P.
1. Opening Balance : Cash in hand & at Banks ..	13,001	7	4				1. Salary, Dearness allowances, Honoraria etc. :						
Unadjusted Suspense of 1952-53	22,362	14	8				(i) Field Section	2,70,087	10	0			
				35,364	6	0	(ii) Statistical & other Sections ..	12,50,565	0	0			
2. Membership Subscriptions ..				2,217	6	0	(iii) Transfer of savings from Director's salary to "Development Fund"	24,000	0	0			
3. Training fees & other receipts ..				10,053	10	0	(iv) Contribution to Workers' Provident Fund	57,643	0	0			
4. Examination fees				9,332	8	0					16,02,295	10	0
5. Block grants and Grants-in-aid from the Government of India, Ministry of Finance :							2. Travelling allowances :						
(i) Research, Training & General purposes				5,20,000	0	0	(i) Field Section	35,476	13	6			
(ii) Multipurpose National Sample Survey				16,76,000	0	0	(ii) Statistical Section	47,029	8	8			
(iii) International Statistical Education Centre (after deduction & adjustment of previous year's closing balance)				35,192	9	0					82,506	8	2
(iv) Manufacturing Industries Survey (after deduction & adjustment of previous year's closing balance)				23,821	5	6	3. Overtime allowances				35,838	14	0
(v) Sample Survey of Refugees in Bombay State				12,000	0	0	4. Contribution to Leave Salary Fund ..				81,500	0	0
(vi) Operational Research Unit ..				40,000	0	0	5. Transfer to Scholarship, Stipends, Visiting Professors & Fellows Fund				40,000	0	0
(vii) Statistical Quality Control Unit				15,000	0	0	6. Prizes to workers for initiative & outstanding performance ..				21,510	0	0
6. Grant received from the Council of Scientific and Industrial Research for the Statistical Quality Control Unit				10,000	0	0	7. Contribution to Gratuity Fund ..				68,200	0	0
							8. Disbursement of Fellowship allowances to ISEC trainees under Colombo Plan				67,277	8	0
							9. Machine Tabulation Expenses :						
							(i) Hire & maintenance of tabulating equipment including freight, customs etc.	1,65,257	1	6			
							(ii) Cost of cards, cabinets etc. ..	1,03,583	4	6			
							(iii) Hire & maintenance of Key punches and verifiers etc. ..	11,024	12	6			
											2,79,865	3	6
							10. Printing & Publications (including paper for printing)				41,830	8	3
							11. Society type activities & Examination expenses				19,746	9	11

7. Amount received from the Taxation Enquiry Commission, Government of India, in connection with punching, verification, tabulation and other statistical work involved in analysing the data of Household Expenditure of the N.S.S.			74,000	0	0	12. Books & Journals (including cost of binding books etc.)		32,733	9	9
8. Amount received from the Press Commission, Government of India, for punching, tabulation and other statistical work in connection with the Newspaper Readership Survey			14,188	0	0	13. Photographic, Optical & Workshop equipment & Stores		19,716	5	0
9. Funds received from the Government of India, Ministry of Finance, for disbursement to the Trainees at the International Statistical Education Centre selected as Fellows under the Technical Co-operation Scheme, Colombo Plan			63,207	7	0	14. Stationeries & Consumable Stores Purchase		41,416	9	9
10. 'Ways & Means' advance received from the Government of India, Ministry of Finance :						15. Repairs & replacements of machineries, equipment, accessories and furniture, fittings etc.		49,669	2	9
(i) For Research, Training & General purposes Scheme	30,000	0 0				16. Auditor's fees		3,035	0	0
(ii) For Multipurpose National Sample Survey	1,57,000	0 0				17. Bank charges and interests		6,049	2	0
			1,87,000	0	0	18. Crop-cutting labour charges & experiments		5,599	0	9
11. Receipts from other sources :						19. Postage, telegrams, telephone & electricity charges & other contingencies		62,625	8	0
(i) Metropolitan Insurance Co., Ltd. (work on bonus cards)			3,794	7	0	20. Rent, rates & taxes including those of Field & Camp offices		54,185	14	0
(ii) Miscellaneous Receipts			2,794	8	0	21. Repairs & maintenance of land & buildings including replacement of building equipment		40,271	12	6
12. Deposits account			2,517	4	3	22. Transport (including salaries of transport unit staff)		39,129	3	0
13. Outstanding liabilities :						23. Workers' welfare & amenities (including salaries of the Welfare units staff)		58,121	0	3
(i) to Creditors			11,544	3	0	24. Development at Director's direction		8,456	11	0
(ii) to Institute's Funded accounts			1,75,000	0	0	25. Purchase of Transport Vehicle		6,300	0	0
14. Receipt by adjustment of expenditure incurred in previous years			3,891	15	10	26. Furniture & Fittings		48,145	10	9
						27. Petty constructions		11,120	10	9
						28. Repayment of outstanding liabilities and advances for expenses incurred in previous years as per last accounts		20,000	0	0
						29. Repayment of previous year's deposits		1,490	9	3
						30. Closing Balances : Cash in hand & at Banks	21,402 9 1			
						Amount under suspense and advance with Baranagar, Calcutta, Delhi, Giridih & Field Sections	58,880 12 2			
								80,283	5	3
		Rs.	29,26,919	9	7			Rs. 29,26,919	9	7

6, HASTINGS STREET, CALCUTTA,
the 20th October, 1954.

Examined and found correct
P. C. NANDI & Co.
Auditors
Chartered Accountants.

APPENDICES

Appendix I

THE COUNCIL

President : The Hon'ble Sri C. D. Deshmukh

Vice-Presidents : Dr. P. N. Banerjea, Dr. S. K. Banerji, Prof. S. N. Bose, Prof. D. R. Gadgil, Sri K. P. Goenka, Sri D. N. Mitra, Sri B. Rama Rao, Sri Shri Ram.

Treasurer : Dr. Satya Churn Law

Secretary : Prof. P. C. Mahalanobis

Joint Secretaries : Sri Nihar Chandra Chakravarti, Sri S.C. Sen.

Members : Srimati Chameli Bose, Prof. K. N. Chakravarti, Sri Mohanlal Ganguli, Prof. H. C. Ghosh, Sri Nimai Charan Ghosh, Prof. K. B. Madhava, Sri K. C. Mahindra, Prof. M. Masuyama, Sri N. T. Mathew, Dr. U. S. Nair, Sri Pitambar Pant, Dr. P. B. Patnaik, Dr. B. Rammurti, Dr. C. R. Rao, Dr. V. K. R. V. Rao, Sri S. C. Ray, Dr. N. Sundarama Sastry, Sri J. M. Sen, Sri Sadasiv Sengupta, Dr. (Miss) S. P. Vaswani.

Appendix II

GOVERNING BODY OF THE RESEARCH AND TRAINING SCHOOL

Sri C. D. Deshmukh, President of the Institute (*Chairman*).

Prof. P. C. Mahalanobis, Secretary and Director of the Institute (*Ex-officio member*).

Prof. K. N. Chakravarti, Registrar of the Institute (*Ex-officio member*).

Sri Bali Ram Bhagat, M.P. (*Representative of the Government of India*).

Sri M. V. Rangachari, Joint Secretary, Ministry of Finance, Government of India (*Representative of the Government of India*).

Dr. N. S. R. Sastry (*Representative of the Reserve Bank of India*).

Dr. U. Sivaraman (*Representative of the Inter-University Board*).

Mr. J. A. R. Tainsh (*Representative of the Associated Chamber of Commerce*).

Sri D. N. Mukherjee (*Representative of the Federation of Indian Chambers of Commerce and Industry*).

Dr. P. V. Krishna Iyer (*Representative of the National Institute of Sciences of India*).

Prof. J. P. Niyogi (*Representative of the Indian Economic Association*).

Prof. S. N. Bose, Sri Shri Ram, Dr. S. K. Banerji, Prof. K. B. Madhava, Sri Nihar Chandra Chakravarti, Sri D. N. Mitra, Dr. P. B. Patnaik (*Representatives of the Indian Statistical Institute*).

Appendix III

AMENDMENTS TO THE MEMORANDUM OF ASSOCIATION

(1) After existing rule 1(c), the following sub-rule shall be inserted :—
"(d) A person who has rendered distinguished services to the Institute may be elected as President or Vice-President of the Institute.

Such election shall be made at a General Meeting of the Indian Statistical Institute on the nomination by a two-thirds majority of the Council for such period as the Council may determine.

The President and the Vice-Presidents, if any, shall enjoy all privileges of membership and shall not be required to pay any fees or subscription but shall not be office-bearers of the Institute.

The President or, in his absence, a Vice-President shall preside at all general meetings of the Institute at which he may be present."

(2) The words "President" and "Vice-President" wherever they occur in the existing rules, shall be substituted by the words "Chairman" and "Vice-Chairman" respectively.

(3) In existing rule 5(a), the following words shall be inserted after the words "the Institute" :—

"which is not attended by the President and of"

(4) The present rule 5(c) shall be substituted by the following :—
"(c) The Treasurer shall be the official custodian of all funds belonging to the Institute."

(5) In rule 5(d), a comma shall be placed after the words "legal transactions" and the following shall be inserted thereafter :—

"shall receive and disburse all funds of the Institute".

(6) After existing rule 6(c), the following shall be inserted :—
"(d) The Chairman and the Secretary of each local branch of the Institute."

(7) Existing rule 11 shall be substituted by the following :—

"11(a) All properties belonging to the Institute and all banking accounts, documents, securities etc. shall stand in the name of the Institute.

(b) All banking accounts and securities shall be operated on by the Treasurer or the Secretary of the Institute or by any two or more persons at least one of whom must be a member of the Council, who may be authorised to do so by the Council."

(8) The amendments noted under items (1), (2) and (3) shall take effect from the time of taking of office by office-bearers and the Council elected for the 1954-55 session but the election of Chairman and Vice-Chairman for that session shall be arranged on the basis of the revised rules.

Appendix IV

Bye-laws relating to Sessional and Student Memberships

By virtue of the powers vested in the Council by Rule 7(a) of the Rules of the Indian Statistical Institute, the Council hereby makes and promulgates the following bye-laws under Rule 4 of the Rules of the Indian Statistical Institute.

1(a) Associates of the Institute as contemplated in Rule 4 shall be of two categories designated by the names of (i) Student members, (ii) Sessional members.

(b) None but a bonafide student of the Institute or any recognised College shall be entitled to be enrolled as a Student member.

2(a) A Student member shall pay an annual subscription of Rs. 6/-.

(b) A Sessional member shall pay an annual subscription of Rs. 10/-.

(c) Subscriptions shall be paid annually in advance, the year being counted from April to March provided that student members may be permitted to pay their subscription in two equal instalments.

3. Sessional members and Student members shall enjoy the following privileges :

(a) To attend all lectures (except those given as a part of any training course) and participate in symposium, technical talks and discussions arranged for members and for the public.

(b) To use the Institute Library except that for taking out books from the Library they may be called upon to deposit caution money at rates prescribed by the administration from time to time.

(c) To participate in all general and social gatherings of the Institute except where admission is restricted by cards for special purposes.

(d) To obtain the Institute's Journal 'SANKHYA' at two-thirds of the price charged to the public.

(e) Such other or further privileges, if any, as may be allowed to them by the Council of the Institute from time to time provided that they are not inconsistent with the rules and present bye-laws of the Institute.

Appendix V

Scale of Contribution for SQC Service

Membership fee will be related to the value of annual sales on the following scale:

category	*value of annual sales*	*annual membership fee*
A	less than Rs. 30 lakhs	Rs. 500
B	Rs. 30 lakhs to Rs. 1 crore	Rs. 1,000
C	above Rs. 1 crore	Rs. 1,500

Membership fee will be on annual basis only, payable in advance.

Local members will be entitled to call on the services of the SQC Unit for advisory, organizational, supervisory and consultation work on payment of service charges on the following scale:

(a) Rs. 175 per month if a Statistician of the Unit has to visit the mill or factory three half-days per week;

(b) Rs. 80 per month if the visits are only twice a month;

(c) Rs. 100 per visit if a mill or factory wants only occasional help and advice.

For outstation members it would only be possible for some time to come, to arrange regular visits by mill or factory technician to the SQC Unit headquarters for consultation:

(a) Three half-days per week on payment of Rs. 175 per month.

(b) Two visits a month on payment of Rs. 80 per month.

(c) Occasional visits on payment of Rs. 100 per visit.

Appendix VI

List of Papers Completed during the Academic Year July 1953–June 1954

Chakravarti, Indramohan

1. On the problem of planning a multi-stage sample survey for multiple correlated characters with illustrations: to be published in *Sankhya*.
2. Comparison of expected lengths of confidence intervals for mean for two methods of sampling from normal populations: for publication.
3. Comparison of two methods of setting confidence intervals in stratified sampling from non-normal populations: for publication.

Des Raj

4. Unbiased ratio estimation in sampling designs: submitted for publication.
5. Some estimators in sampling with varying probabilities: submitted for publication.
6. On sampling with varying probabilities in multi-stage designs: accepted for publication in *Ganita*, vol. 5.
7. On estimating parameter functions in stratified sampling designs: submitted to *Sankhya*.

Gayen, A. K.

8. On setting up control charts for non-normal samples: *Indian Society for Quality Control Journal*, vol. 1, no. 1.
9. Control limits for means and variances for Edgeworth populations: presented at the Indian Science Congress, Jan. 1954.
10. (With R. P. Saha) Factors in the study of personality and weighting item responses in psychological tests: presented at the Indian Science Congress, Jan. 1954.

Kallianpur, G.

11. (With H. Robbins) An ergodic property of the Brownian motion process: *Proc. Nat. Acad. Science*, U.S.A. 1953.
12. (With H. Robbins) On the sequence of sums of independent random variables: *Duke Mathematical Journal*, June 1954.
13. On an ergodic property of a certain class of Markov process: submitted to *Proc. of Amer. Math. Society*.

14. A note on the Robbins Monro stochastic approximation method : *Ann. of Math. Stat.*, June 1954.
15. On a method of estimating the sum of unknown areas : submitted to *Ann. of Math. Stat.*

KAMATH, H. K.

16. A study of measure in locally bicompact Hausdorff spaces.
17. (With E. M. Paul) Outer Measure in topological spaces.

KUDO, A.

18. On a property of *t*-statistic : to be published.
19. On problems in greater mean : to be published.

LAHA, RADHA GOVIND

20. On a characterization of the multi-variate normal distribution : presented at the Indian Science Congress; Jan. 1954.
21. On a characterization of the Gamma distribution : *Ann. of Math. Stat.* (in press).
22. (With D. Sarkar) On a modification of the variate-difference method : submitted to *Econometrica.*
23. (With J. Roy and S. Mitra) On bounds of the maximum latent root of real symmetric matrices : to be published in *Sankhya.*
24. (With J. Roy) On the power function of the frequency chi-square : to be published.

MAHALANOBIS, P.C.

25. The foundations of probability : presented at the International Symposium of Statistics, Zurich, April 1953. *Dialectica*, 1954.
26. Some observations on the process of growth of national income: *Sankhya*, vol. 12, 4, 1953.
27. (With S. B. Sen) On some aspects of the Indian National Sample Survey : presented at the International Statistical Conference, Rome, Sept. 1953.

MASUYAMA, M.

28. A note to "rapid methods of estimating the sum of specified areas etc.," : submitted to *Ref. Stat. Appl. Res.*
29. On the unification of two approximations of a non-central F-distribution : submitted to *Ref. Stat. Appl. Res.*
30. Tables of two-sided 5% and 1% control limits for individual observation of the rth order : submitted to *Sankhya.*
31. On the quasi-population-free property of some coefficients: submitted to *Sankhya.*
32. Applications of Integral Geometry to areal sampling problems, Parts III and IV : submitted to *Sankhya.*
33. (With J. M. Sengupta) Application of Integral Geometry to areal sampling problems, Part V : submitted to *Sankhya.*

MATTHAI, ABRAHAM

34. On selecting random numbers for large scale sampling : *Sankhya*, 13, 3, 1954.
35. On optimum allocation of sample sizes when there are more than one variable under investigation : to be published.
36. (With J. Roy and S. Mitra) Sampling inspection plans for gauging : to be published.

MITRA, SUJIT KUMAR

37. On minimum variance estimation of location and scale parameters: submitted to *Ann. of Math. Stat.*
23. (With J. Roy. and R. G. Laha) On bounds of the maximum latent root of real symmetric matrices : submitted to *Sankhya.*
38. (With J. Roy) Selection for improvement : *Cal. Stat. Assn. Bull.*, March 1954.

39. (With J. Roy) A note on the planning of experiments when cost depends on outcome.
36. (With A. Matthai and J. Roy) Sampling inspection plans for gauging : to be published.

PATNAIK, P. B.

40. A test of significance of the difference between two sample proportions when the proportions are very small ; to be published in *Sankhya*.
41. Hypothesis concerning the means of observations in normal sample: submitted to *Sankhya*.
42. A study of the non-central range distribution : submitted to *Biometrika*.
43. Precision of the components of variance in sampling designs : to be published.

PAUL, E. M.

44. New proofs of theorems concerning the distribution of quadratic forms : to be published.
17. (With H. N. Kamath) Outer measure in topological spaces.

RAMACHANDRAN, G.

45. An empirical study of the power of certain non-parametric tests: included in the Ph.D. thesis submitted to the Madras University.
46. The distribution of the sample number in sequential tests when sampling is from (1) a changing population, (2) a truncated population: included in the Ph.D. thesis submitted to the Madras University.

RAMAKRISHNAN, C. S.

47. A note on tolerance limits for a normal population.
48. A decision function approach to problem of discrimination : to be published.

RAMASWAMY, G.

49. Time variations in cosmic ray intensity : preliminary report.
50. A class of asymptotically sub-minimax estimators of the parameter of binomial distribution for quadratic loss function : to be published.

ROY, J.

51. On a computational technique useful in testing the independence of two sets of normal variates when a third set is fixed : presented at the Indian Science Congress, Jan. 1954.
52. On the power function of the likelihood ratio test used in analysis of disporsion : part of Ph.D. thesis to be submitted to the Calcutta University.
38. (With S. Mitra) Selection for improvement : *Cal. Stat. Assn. Bull.*, March 1954.
39. (With S. Mitra) A note on the planning of experiments when cost depends on outcome : to be published.
23. (With R. G. Laha and S. Mitra) On bounds of the maximum latent root of real symmetric matrices : to be published in *Sankhya*.
24. (With R. G. Laha) On the power function of the frequency chi-square : to be published.
36. (With S. Mitra and A. Matthai) Sampling inspection plans for gauging : to be published.

RUDRA, A.

53. A method of discrimination in time-series analysis : *Bull. Cal. Stat. Assn.*
54. Discrimination in time series, Parts I & II : submitted to *Sankhya*.
55. Problems of goodness of fit and discrimination with regard to linear regressive models : to be published.
56. On the evaluation of a Laurent covariance determinant.
57. Estimation and distribution problems in time-series analysis.

SARKAR, D.

22. (With R. G. Laha) On a modification of the variate difference method : submitted to *Econometrica*.

SEN, S. B.

27. (With P. C. Mahalanobis) On some aspects of the Indian National Sample Survey : presented at the International Statistical Conferences, Rome, Sept. 1953.

SRIKANTAN, K. S.

58. The determination of a single outlier in a regression model : submitted to *Sankhya*.

59. The numerical evaluation of the distribution of a polynomial in a tabulated variate : to be published.

SRINIVASAN, M. S.

60. Enumeration of positive rational numbers : presented at the Indian Mathematical Conference, Delhi, December 1953.

61. Median series and singularity of convergents of regular continued fractions : to be published.

VENKATARAMAN, M. V.

62. Statistical study of absenteeism in Indian Industries : *Bull. Cal. Stat. Assn.* (in press).

63. Absenteeism in the Indian Cotton Mill Industries : submitted to the *Indian Economic Journal*.

VIKRAMAN, V.

64. An approach to the Radon-Nikodym Theorem : submitted to the *Journal of the Indian Mathematical Society*.

Appendix VII

SCIENTIFIC ENQUIRIES

1. Sri K. Subrahmanyam, M.A., M.Sc., Assistant Professor of Biochemistry, Medical College, Cuttack : Determination of the biological value of different diets.
2. Dr. S. P. Ghosh, Department of Psychology, Calcutta University : Prediction of success at school examinations of normal and deaf and dumb boys and girls on the basis of psychological tests.
3. Sri R. K. Misra, Lecturer in Mathematics, University of Saugar, M.P : Allometric growth of fresh water prawns.
4. Sri K. H. Sujansingani, Research Assistant, Inland Fisheries Research Station, Calcutta : Relative growth of fish.
5. Dr. V. G. Jhingran, Research Officer, Inland Fisheries Research Station, Allahabad : Health index of fish (The work was started last year and continued this year also).
6. Entomologist, Department of Agriculture, Government of West Bengal, Calcutta : Determination of the optimum dilution of an insecticide.
7. Prof. S. D. Chatterjea, Ottawa : Cosmic Ray intensity variations in ionization records of S. D. Chatterjea, made available through Dr. C. R. Rao.

Appendix VIII

LIST OF OFFICERS-ON-DEPUTATION

1. (Miss) Sunitee Dutta, *Research Scholar, Central Institute of Education, Goverment of India, Delhi* : (1 January 1953—25 August 1953) : Educational Psychology.
2. R. K. Misra, *Lecturer in Mathematics, University of Saugar* : (26 March 1953—18 May 1953) : General statistical method,
3. Ayodhya Prasad, *Junior Research Assistant, Behar Agricultural College, Sabour, Bhagalpur* : (15 April 1953—27 June 1953) : Statistical applications in genetics.
4. U. V. Ramamohana Rao, *Research Scholar in Statistics, Andhra University* : (15 April 1953—16 June 1953) : Mathematical statistics.
5. S. Ramaswami, *Indian Finance, Calcutta* : (2 October 1953—13 October 1953) : Agricultural statistics.
6. Dr. A. R. Son, *Economics and Statistics Dept., Government of U.P., Lucknow* : (27 October 1953—7 November 1953) : Analysis of crop-survey data collected by him.

7. K. P. George, *Lecturer in Mathematics, St. Joseph College, Darjeeling* : (15 January 1954—26 February 1954) : Educational statistics.

8. N. P. Mahadevan, *Osmania College, Kurnul* : (29 March, 1954) Practical statistics.

Appendix IX

List of Trainees in the ISEC Fifth Term (January to June 1953)

1. U. Saw Mung (*Burma*), 2. Daw Khin Thaung (*Burma*), 3. Promode Ranjan Ghose (*India*), 4. H. R. Gupta (*India*), 5. Jyotirmoy Karkun (*India*), 6. Radha Charan Khuntia (*India*), 7. H. C. Kothari (*India*), 8. Sediono Notoadhiwinoto (*Indonesia*), 9. *B. L. Rajbhandari (*Nepal*), 10. *M. A. Majid (*Pakistan*), 11. *M. A. Rashid (*Pakistan*), 12. *M. S. Zaman (*Pakistan*), 13. Syed Rahmat Ali (*Pakistan*), 14. Ch. Rinet Ali Khan Bajwa (*Pakistan*), 15. Mriza Mohamad Kazim Beg (*Pakistan*), 16. M. I. Haq (*Pakistan*), 17. Mahammed Hossain (*Pakistan*), 18. Mohammed Abdul Karim (*Pakistan*), 19. M. Amin Mir (*Pakistan*), 20. Malik Ghulam Mohyyuddin (*Pakistan*), 21. Khwaja Rashidullah (*Pakistan*), 22. Sayed Shujaat Ali Shah (*Pakistan*), 23. *P. V. Alzate (*Philippines*), 24.*M. Garcia (*Philippines*), 25. Domingo C. Alonzo (*Philippines*), 26. Felipe Rey Hipolito (*Philippines*), 27. Emilio A. Santos (*Philippines*), 28. Mira M. Sarda (*Philippines*), 29. M. Krishnachinda (*Thailand*), 30. S. Limpisavasti (*Thailand*).

List of Trainees in the ISEC Sixth Term (July to December 1953)

1. Khin Than Myint (*Burma*), 2. Shew Gai (*Burma*), 3. D. P. Guneratne (*Ceylon*), 4. Nirmalesh Ghosh (*India*), 5. S. N. Ghosh (*India*), 6. Jagadish Pd. Kulshreshtha (*India*), 7. Shyam Behari Lal (*India*), 8. P. Bhaskarannair (*India*), 9. Sitaraman Prasad (*India*), 10. Padam Nabh Sharma (*India*), 11. Henri Harsono (*Indonesia*), 12. J. Abdul Malik (*Indonesia*), 13. *Sediono Notoadhiwinoto (*Indonesia*), 14. Sho Akashi (*Japan*), 15. Kuzuhiko Asama (*Japan*), 16. *B. L. Rajbhandari (*Nepal*), 17. Mir Iftikhar Hasan (*Pakistan*), 18. *Mohammed Hossain (*Pakistan*), 19. *Mohammed Abdul Karim (*Pakistan*), 20. Abdur Rashid Malik (*Pakistan*), 21. Khwaja Rashidullah (*Pakistan*), 22. *M. S. Zaman (*Pakistan*), 23. *Domingo C. Alonzo (*Philippines*), 24. Mateo B. de Dios (*Philippines*). 25. Carmen R. Reloj (*Philippines*).

List of Trainees in the ISEC Seventh Term (January to June 1954)

3. Flt. Lt. T. T. Karamchandani (*India*), 4. Narain Prakash Srivastava (*India*), 5. Rajendra Kumar Misra (*India*), 15. *Henri Harsono (*Indonesia*), 24. *Carmen R. Reloj (*Philippines*).

1. Ma Khine Khine (*Burma*), 2. U. Htin Gyaw (*Burma*), 6. Abdul Khaleque (*India*), 7. Jatinder Nath Sharma (*India*), 8. Madan Mohan Misra (*India*). 9. N. L. Sharma (*India*), 10. Rakhal Chandra Giri (*India*), 11. Satinder Kumar Jain (*India*). 12. Siv Dayal (*India*), 13. S. R. Pathak (*India*), 14. S. Vadivelu (*India*), 16. J. Soeparko (*Indonesia*), 17. Soemartono (*Indonesia*), 18. Kritendra Kumar Malla (*Nepal*), 19. Abdul Habib (*Pakistan*), 20. Agapito M. Garcia (*Philippines*), 21. Doroteo N. V. Girado (*Philippines*), 22. Bui Thi Dung (*Viet Nam*), 23. Than Thi Hong (*Viet Nam*).

Appendix X

List of Trainees in the Research and Training School

Trainees who completed the two-year training Course in June 1953 :

1. Dubey, S. D. (*Bihar*), 2. Gnanadeshikan, R. (*Annamalainagar*), 3. Gopalkrishnan, M. S. (*Madras*), 4. Gupta, K. R. (*Madras*), 5. Iyengar, K. R. R. (*Madras*), 6. Mukherjee, A. K. (*Rajasthan*), 7. Padmanabhan, M. (*Madras*), 8. Ramakrishnan, C. S. (*Chittur Cochin*), 9. Ramakrishnan, V. (*Trivandrum*), 10. Reddy, K. G. (*Madras*), 11. Srikantan, K. S. (*Madras*), 12. Srinivasan, V. (*Madras*), 13. Subramanian, T. A. (*Madras*), 14. Sundaram, P. M. (*Trivandrum*), 15. Sundararajan, T. V. (*Madras*). 16. Vikraman, V. (*Madras*).

Second Year Class, 1953-54 :

1. Aikot, J. K. (*Bihar*), 2. Balakrishnan, T. R. (*Travancore-Cochin*), 3. Bansal, J. P. (*U.P.*), 4. Bhasin, K. K. (*Punjab*), 5. Doraiswamy, P. K. (*Coimbatore*). 6. *Gopala-

*Trainees staying over from the previous term.

desikan, V. N. (*Madras*), 7. Gupta, H. G. (*Punjab*), 8. Gupta, R. S. (*Punjab*), 9. Ravi Kumar (*Punjab*), 10. Premi, M. K. (*U.P.*), 11. Prasad, C. R. (*Madras*), 12. *Rama Rao, M. S. (*Madras*), 13. Singal, M. S. (*Punjab*), 14. Singh, Pritam (*Punjab*), 15. Sinha, S. K. (*West Bengal*), 16. Sivaramakrishnan, P. V. (*Madras*), 17. Sundaresan, K. S. (*Madras*).

*Admitted to 2nd year class after a test examination.

First Year Class, 1953-54 :

1. *Aggarwal, S. L. (*Punjab*), 2. Bhasin, Y. P. (*Punjab*), 3. Hariharan, G. (*Bombay*), 4. Iyer, S. Ramanatha (*Poona*), 5. Jain, R. C. (*U. P.*), 6. Bai, R. Kastoori (*Madras*), 7. Kukreja, O. P. (*U.P.*), 8. Nair, G. K. (*Travancore-Cochin*), 9. *Nayudu, W. R. (*M.P.*), 10. Rajagopal, S. (*Madras*). 11. *Saksena, B. S. (*U.P.*) 12. Sangal, S. P. (*U.P.*). 13. Sharma, H. C. (*Himachal Pradesh*), 14. Sharma, B. V. R. (*Madras*), 15. Sethi, V. K. (*U.P.*), 16. Srinivasan, T. N. (*Madras*).

*Discontinued.

Appendix XI

LIST OF SUCCESSFUL CANDIDATES IN DIFFERENT EXAMINATIONS : 1953-54
STATISTICIAN'S DIPLOMA EXAMINATION : AUGUST 1953

A. GENERAL PAPERS

PAPER I (*Theoretical*) : K. Mukundan, Manohar Shriram Pandit, S. Rangachari, Promode Kumar Gupta,

PAPER II (*Theoretical*) : K. M. Lakshminarasinghum, Sarash Chandra Gopal Maghe, D. Srinivasan, Balachandra Mahadeo Sathye, Manohar Ganpatrao Jawle, Venu Achyut Dabholkar, Nathu Ram, Narayan Damodar Joshi, Shiva Chandra Garg, Vasudeo Vyasacharya Ghalsasi, R. T. Sampatkumar Tatachari, Sulabha Dhananjaya Gadgil, K. Jayachandran, Ramchandra Vishnu Damble, S. Rangachari, Nandury Gopalkrishna Murthy, Shakharam Trimbak Awade.

PAPER III (*Theoretical*) : Vinayak Madhav Bhise, Viswanath Sadashiv Tulpule, Promode Kumar Gupta, Hemlata Vaman Gadkari, Amiyamoy Chatterjee, Sadasiv Ramchandra Gokhale, S. Harihar Iyer, Nandury Gopalkrishna Murthy, R. T. Sampatkumar Tatachari, Shriremkrishna Karandikar.

PAPER VI (*Practical*) : Hansraj Sharma, Manohar Shriram Pandit, Hemlata Vaman Gadkari, Nandury Gopalkrishna Murthy, Vasudeo Vyasacharya Ghalsasi.

PAPER VII (*Practical*) : Hansraj Sharma, Hemlata Vaman Gadkari, Sarash Chandra Gopal Maghe, T. Jacob.

B. SPECIAL PAPERS IV & V (*Theoretical*)

(i) *Sample Survey* (*Applied*) : Hansraj Sharma, Nathulal Garg, Shiba Chandra Garg.

(ii) *Sample Survey* (*Theory*) : Vasant Jagannath Puntambekar, Yamuna Shridhar Ghaisas, Hansraj Sharma, K. Ramachandran.

(iii) *Mathematical Theory of Sampling Distributions* : S. Rangachari

(iv) *Statistical Quality Control* : Amiyamoy Chatterjee, K. Jayachandran, Ramprakash Malhotra, Sadashiv Ramchandra Gokhale, Ramesh Shankar, Nandury Gopalkrishna Murthy.

(v) *Design of Experiments* : Ramesh Shankar.

(vi) *Economic Statistics* : V. S. Honwad, Anant Raghvendra Kulkarni, Shiba Chandra Garg, Sulabha Dhananjaya Gadgil, Nathulal Garg, Manohar Shriram Pandit, Narayan Damodar Joshi.

(vii) *Vital Statistics and Population Studies* : Vasant Jagannath Puntambekar, Yamuna Shridhar Ghaisas, Manohar Ganapatrao Jawle, K. Ramachandran.

SPECIAL PAPERS VIII & IX (*Practical*)

(i) *Sample Survey* (*Applied*) : Hansraj Sharma.

(ii) *Sample Survey* (*Theory*) : Vasant Jagannath Puntambeker.

(iii) *Mathematical Theory of Sampling Distributions* : S. Rangachari

(v) *Economic Statistics* . Monohar Shriram Pandit

(vi) *Vital Statistics and Population Studies* : Vasant Jagannath Puntambekar K. Ramachandran, Yamuna Shridhar Ghaisas Nandury Gopalkrishna Murthy.

COMPUTER'S CERTIFICATE EXAMINATION : JULY 1953

IA : SECTION 1 : Anu Ranjan Mukherjee, Gour Chandra Mukherjee, Sreesh Chandra Paul, Nagendra Nath Das, Chittaranjan Banerjee, Kalyan Gupta, Nisith Choudhury, Sashi Bhusan Roy, Kalidas Chatterjee, Santosh Kumar Bhattacharyya, Bijoy Krishna Taluqdar, Radhasyam Nath, Sibdas Chattopadhyaya, Prahlad Chandra Bhowal, Subodh Kumar Mukherjee, Raghunath Banerjee, Jyoti Kumar Roy, Narayan Chandra Chakravarti, Sudhindra Chandra Dutta, Ashit Kumar Ghosal, Amal Kumar Ghosal, Sadhan Das Gupta, Amulya Kumar Das, Amar Nath Chakravarti, Nirmal Chandra Sirkar, Sunil Kumar Dutta, Krishnadhan Mukherjee, N. Jayaraman, B. Vasantkumar, Gajanan Shivaram Errum, Vinayak Mohaniraj Shaligram.

IA : SECTION 2 : Sreesh Chandra Paul, Radhasyam Nath, Raghunath Banerjee, Chittaranjan Nath Bhowmik, Madhav Chandra Chakravarti, Amal Kumar Ghosal, Mrinalini Ghosh, B. Vasantkumar, Gajanan Shivaram Errum, Vinayak Mohaniraj Shaligram.

IB : SECTION 1 : Malay Kumar Chanda, Gour Gopal Rudra, Subimal Kanti Majumdar, Subir Kumar Roy, Arun Kumar Chakravarti, Adhir Chandra Nag, B. Vasantkumar, Vinayak Mohaniraj Shaligram, Lakshman Sripad Dandge.

IB : SECTION 2 : Prabir Chandra Sen, Mukti Nath Mukherjee, Baidyanath Palit, Jyoti Kumar Roy, Leela Dasgupta, Gajanan Shivaram Errum, Vinayak Mohaniraj Shaligram.

IC : SECTION 1 : Malay Kumar Chanda, Sukamal Das, Radharaman Roy, Gajanan Shivaram Errum, Vinayak Mohaniraj Shaligram.

IC : SECTION 2 : Malay Kumar Chanda, Baidyanath Palit, Mohan Kisen Ogra, Raghunath Banerjee, Leela Dasgupta, Adhir Chandra Nag.

FIELD SURVEY EXAMINATION : JUNE 1953

PART IA : Barindra Kumar Banerjee, Rabindra Nath Ganguly, Shyam Kishore Majumdar, A. Majumdar.

PART IB : Barindra Kumar Banerjee, Rebati Mohan Chakravarti, Rabindra Nath Ganguly, Shyam Kishore Majumdar, A. Majumdar.

PART IC : Barindra Kumar Banerjee, Rabindra Nath Ganguly, Shyam Kishore Majumdar, A. Majumdar.

PART IIA : Barindra Kumar Banerjee, Rabindra Nath Ganguly, Shyam Kishore Majumdar, A. Majumdar.

PART IIB : Barindra Kumar Banerjee, Shyam Kishore Majumdar, Chandidas Banerjee, B. K. Venkata Rangan, Sushil Chandra Dhar.

Appendix XII

LIST OF PRIZE WINNERS

1. Abdul Kader (Rs. 300), 2. Adhir Chandra Adhikary (Rs. 300), 3. Dhan Bahadur Lama (Rs. 400), 4. Bishnu Pal (Rs. 400), 5. Chitta Chattaraj (Rs. 600), 6. Chandi Banerjee (Rs. 500), 7. Dhiren Sarker (Rs. 750), 8. Devendu Bhattacharjee (Rs. 500), 9. Chitta R. Saha Roy (Rs. 300), 10. Late Gayanath Adak (Rs. 2000), 11. Haradhan Maity (Rs. 200), 12. Halima Bibi (Rs. 300), 13. Harendra Paul (Rs. 300), 14. Hari Charan Giri (Rs. 300), 15. Haren Chatterjee No. 1 (Rs. 300), 16. Jiten Taluqdar (Rs. 1500), 17. Jyotsna Datta Roy (Rs. 300), 18. Jogabrata Roy (Rs. 500), 19. Kanakeswar Roy (Rs. 400), 20. Keshab Poddar (Rs. 1000), 21. Keshab Dutta (Rs. 400), 22. Kali Prasanna Roy (Rs. 600), 23. Karan Singh (Rs. 300), 24. Nagendra Swar (Rs. 300), 25. Lokenath Saha Roy (Rs. 500) 26. Probhat Sinha (Rs. 750), 27. Pabitra Das (Rs. 400), 28. Pran Kr. Banerjee (Rs. 300), 29. Rasallat Hossain (Rs. 300), 30. Rajen Roy (Rs. 600), 31. Sujit Mitra (Rs. 500). 32. Shava Ranjan Chakraborty (Rs. 300), 33. Subodh Das Gupta (Rs. 3000). 34. Sashi Chakraborty (Rs. 500), 35. Shyam Bose (Rs. 500), 36. Tarani Pal Roy (Rs. 400).