

## CHAPTER VII

### INDIAN STATISTICAL INSTITUTE

7.1 The Indian Statistical Institute (ISI) came into being with the pioneering initiative and efforts of Professor P.C. Mahalanobis in early thirties (registered on 28 April, 1932). The Institute expanded its research, teaching, training and project activities and got national/international recognitions. The Institute was recognized as an “Institute of National Importance” by an Act of Parliament, known as “Indian Statistical Institute Act No.57 of 1959”. Significantly, Pandit Jawaharlal Nehru, the then Prime Minister piloted the bill in the Parliament in 1959. This Act conferred the right to hold examinations and award degrees/diplomas in Statistics. Degree courses viz. Bachelor of Statistics (B.Stat.), Master of Statistics (M.Stat.) and post graduate diplomas in SQC & OR and Computer Science were started from June 1960. The Institute was also empowered to award Ph.D./D.Sc. degree from the same year. Subsequently, Master of Technology courses in Computer Science and in Quality, Reliability & Operations Research were also started. The Institute’s scope was further enlarged to award degrees/diplomas in Statistics, Mathematics, Quantitative Economics, Computer Science and such other subjects related to Statistics by virtue of “Indian Statistical Institute (Amendment) Act, 1995. The Institute took up research activities not only in Statistics/Mathematics but also in Natural and Social Sciences, Physics and Earth Sciences, Biological Sciences, Statistical Quality Control & Operations Research and Library and Information Sciences.

7.2 Sankhya – The Indian Journal of Statistics, being published by the Institute since 1933, is considered as one of the leading Statistical Journals of the world. Pioneering research activities were strengthened and new directions were opened up by Professor C.R. Rao and many others in the Institute. Research in economics was greatly stimulated when in 1954 Prime Minister Jawaharlal Nehru entrusted the preparation of the draft Second Five-Year-Plan of the country to Professor Mahalanobis, Director of the Institute. The planning models formulated by Professor Mahalanobis have been regarded as major contributions to economic planning in India. In the field of Computer Science, the Institute has a rich tradition. In 1953, a small analog computer was built in the Institute. In 1956, the Institute acquired a HEC-2M machine from the U.K. which was the first digital computer in India. In early sixties, the Institute, in collaboration with the Jadavpur University, undertook the design, development and fabrication of a fully transistorised digital computer, called ISIJU-1 which was commissioned in 1966. The ISI also played a pioneering role in starting the Statistical Quality Control (SQC) movement in India. Professor W.A. Shewhart, the father of SQC. Dr. W.E. Deming, Dr. Ellis R. Ott, Dr. H.C. Tippet and Genichi Taguchi were invited to India for SQC promotional work. The Institute has been interacting with many internationally reputed scientists in statistics like Sir Ronald A. Fisher, (a pioneer of modern statistics), Professor J.B.S. Haldane, (a geneticist) the celebrated mathematician, Norbert Wiener Harold Hotelling, Frank Yeats, Herman Wold, Edwin Harper (Jr.) and H. Cramer, the mathematicians A.N. Kolmogorov, Yu. V. Linnik, J.L. Doob and more recently Vaughan F.R. Jones, (the experts in Statistical Quality Control) Walter Shewhart and G. Taguchi, (the Economists) Simon Kuznets, Paul A.

Baran, Joan Robinson, Jan Tinbergen, Nicholas Kaldor, R.M. Goodwin, David and Ruth Glass and J.K. Galbriath; the geologist Pamela Robinson; the biochemist N.W. Pirie and the linguist D. Kostic. All along the Institute has tried to live up to Ronald Fisher's dictum that Statistics is a "Key Technology" of the century.

7.3 Dr. N. R. Madhava Menon, Prof. M.G.K. Menon, FRS and Prof. K.B. Sinha, Distinguished Scientist acted as the Chairman, the President and the Director of the Institute respectively during the year.

### **Teaching and Training**

7.4 During the academic session 2003-04 courses offered by the Institute are B.Stat. (Hons.), B. Math (Hons.), M.Stat (Math. and Stat. Stream), M.S. in Quantitative Economics, M.Tech. in Computer Science, M.Tech. in Quality, Reliability and Operations Research, Two-year part-time Post-Graduate Diploma in SQC & OR (Chennai); Research Fellowships in Statistics, Mathematics, Economics, Computer & Communication Sciences, Theoretical Physics and Applied Mathematics, Anthropology, Demography, Geology, Sociology, Psychometry, Biochemistry, Agricultural Sciences, Embryology and one year part time course in Statistical Methods and Applications and course on Computer Programming and Applications. Admission tests were conducted at **24** different Centres all over the country. **4219** candidates appeared for the admission tests and **521** candidates qualified for interview and **190** candidates were offered admission. There are **303** students prosecuting studies in ISI.

### **Professional Examinations in Statistics**

7.5 Examination Committee of the Institute conduct professional examinations for the Junior Diploma in Statistics and Senior Diploma in Statistics at Bangalore, Kolkata, Delhi, Mumbai, Hyderabad, Chennai twice in a year usually in the month of April/May and November/December respectively. During the period, the cumulative total number of students who have qualified for award of the Diplomas in the professional examinations in statistics is **297**. The Govt. of India recognises the Junior Diploma in Statistics as equivalent to Bachelor's Degree in Statistics and Senior Diploma in Statistics to a Master's Degree in Statistics.

### **International Statistical Education Centre (ISEC)**

7.6 The ISEC opened in 1950, is operated jointly by the International Statistical Institute, the Indian Statistical Institute and the Government of India. The Centre as an associated body of the Institute functions under a joint Board of Directors. Professor P.C. Mahalanobis was the Chairman of the Board of Directors since its inception (1950) upto 1972. Since then, National Professor C.R. Rao, F.R.S., has been the Chairman of the Board. The Centre provides training in Theoretical and Applied Statistics at various levels for selected participants from the countries in the Middle-East, South and South-East Asia, the Far East and the Commonwealth countries in Africa, sponsored by respective Governments. Major training programme of the Centre is a 10-month regular course in statistics. During 2003-04, **10** students from **4** countries are participating in this centre.

## Research

7.7 The research activities are being carried in the following areas viz. Theoretical Statistics and Mathematics; Applied Statistics; Physics and Earth Sciences; Computer and Communication Sciences; Biological Sciences; Social Sciences; Statistical Quality Control and Operations Research and Library, Documentation & Information Sciences. In addition, the Computer and Statistical Services Centre (CSSC) provides computing and statistical services to scientific workers. There are **108** Doctoral and **26** post doctoral researchers in ISI.

## Statistical Quality Control and Operations Research

7.8 The SQC and OR set up in 1953, operates with 10 units located at Bangalore, Baroda, Calcutta (2 units), Hyderabad, New Delhi, Mumbai, Coimbatore, Chennai, Pune. Since its inception, the division has been very active in the dissemination of statistical based knowledge to industries and applied research in the areas of SQC & OR. A specialist development programme (SDP) is run to provide career in industry through on the job training and guided development. A Post graduate two year programme, M.Tech (Quality Reliability and Operation Research) is run from 1989. The Divisional faculties also took part in ISEC regular course on Statistical Quality Control and Operations Research (SQC & OR). The Division also runs part-time certificate courses in SQC & OR at a number of centers. The theoretical research activities carried out during the year are in the areas like Equivalence of P and Q properties for double-sided multiplication transformation  $M_A(X)=AXA^T$ , non-normal process capability analysis, Linear and semidefinite Complimentarity Problem, non co-operative games, stochastic games, Consecutive K-out-of-n : F System, Multiple objective programming, applied regression analysis with special emphasis on deletion diagnostics, collinearity and heteroscedasticity, sensitivity analysis in multivariate statistical process control, small sample corrector for estimators of mean of normal distribution, change point analysis of hazard rates and mean residual life, construction of visual cryptographic schemes, economic design of control chart when failure follows logarithmic series distribution, performance evaluation of different category of models for software reliability predictions. Some of the interesting areas of applied research where the faculties of the Division were engaged are as follows: (a) Designing a new high performance and cost efficient compressor model for mini refrigerator and water cooler; (b) Modeling of the measurement processes of earing percent for closure stock; (c) Evaluation of reliability of a unit of Flight Control Software; (d) Reliability evaluation of solid rocket motor of ISRO-PSLV/GSLV; (e) Scientific management system for irrigation and water supply; (f) Optimization of cigarette design; (g) Developing a project management efficiency metric; and (h) Warranty cost analysis. This also conducts several seminars, symposium, training and workshop on Black Belt, Green Belt, Design of Experiments, Statistical Process Control, Internal Audit (Quality), Statistical Tools for Quality, ISO 9000 Quality System Standard.



Prof. S.S. Vijayar, Head, Applied Statistics Unit delivering his speech during the inaugural session of the workshop on "Teaching of Computer Science in Schools" held at Indian Statistical Institute, Kolkata during September 05-26, 2005.



Prof. S.S. Saha, Director, ISI is seen accompanying Mr. J.B. Mondal, Mr. T.K. Mukherjee, Mr. T.K. Mukherjee, Mr. S.K. Ghosh, Secretary, Ministry of Statistics and Programme Implementation, Government of India at the Ministry during their visit to the Indian Statistical Institute, Kolkata on May 21, 2005.

## **Library, Documentation and Information Sciences Division**

### **(a) Central Library**

7.9 The Institute has a central research Library at Kolkata with a holding of above 2 lakh books and bound periodicals. It has a good collection of microfilms and photofilms. It renders regular documentation service to the Institute Scientists. It has also a well equipped Reprography and Photography Unit with facilities for all modern copying arrangement. The reading room of the Library has accommodation for about 200 readers. The services of the Library are extended to bonafide students, scholars and academic staff members of educational and scientific Institutions of the city and its neighbouring regions. The Library maintains contacts with research Libraries of the country through inter-library loan transactions. The Library has also an excellent collection of rare and out of print books, official reports and data books of various governments and international agencies and Russian language publications. A separate collection of books and journals is being developed for a Regional Library for Eastern Zone as “**NBHM collection**” funded by National Board of Higher Mathematics, Dept. of Atomic Energy, Govt. of India. To provide information support and increase efficiency of library services, the Central Library at Kolkata has started the process of providing computerised library services. Libraries at Delhi and Bangalore also provide the similar services. National Board of Higher Mathematics, Department of Atomic Energy, Govt. of India has recognised Indian Statistical Institute, Delhi Centre Library as the Regional Library to serve the Northern Region.

### **(b) Documentation Research and Training Centre (DRTC)**

7.10 The activities of the centre include study of various methods of knowledge representation, such as semantic nets, frames and predicate calculus etc.; the application of the modern scientific management techniques to the planning and management of information system, centers and services; the Study of Internet Technology and its Applications; the development of bibliometric and scientometric measures for evaluating the use of Library and information services and scientific output respectively; the development of guidelines and software for Library house keeping operations, such as, circulation control service and acquisition control. Etc.

### **Computer and Statistical Services Centre (CSSC)**

7.11 The centre manages the central computing facilities of the Institute at Kolkata. It serves about 600 users including students, research scholars and scientific workers with the inhouse computers SUN Enterprise 3000 Server, six (6) SUN ULTRA 30 workstations, ten (10) SUN Blade 100 workstations, DEC Alpha 4100 server, IBM AS-400 server and fifty five (55) PCs. BMDP, SAS, IMSL, SHAZAM TSP, Matlab, Mathematica, S-Plus, GIS softwares are available at the center. E-mail, Internet and campuswide network of the Institute are maintained by the Centre. Statistical and computational consultancy services are also provided by CSSC. The staff members of CSSC also serve as faculty in various courses of the Institute. CSSC conducted courses on computer programming and packages for North Eastern (NE) States of India. They also conducted research in the areas of Database, Image Processing and Data Mining.

## **Financial Support from Government and Others**

7.12 The Institute also undertook a variety of externally funded projects from different Government and Non-Government organisations like Dept. of Science and Technology (DST); Food Corporation of India (FCI); NEI; Oil and Natural Gas Commission (ONGC); ORG Marg Research Ltd.; VS Ltd.; Dept. of Atomic Energy, Govt. of India (NBHM); NSF; Indian National Science Academy (INSA); Indo-French Centre for the Promotion of Advanced Research (IFCPAR); Govt. of West Bengal; Ministry of Defence, Doordarshan Kendra, Kolkata; Ministry of Information Technology; European Commission; C-DAC; Reserve Bank of India (RBI); Defence Research Development Organisation (DRDO); Govt. of West Bengal (GoWB); Indo-French Centre for the Promotion of Advanced Research, New Delhi; Intel Corporation, USA; Labour Department, Govt. of West Bengal; West Bengal Women's Commission; Central Scientific and Industrial Research (CSIR); Rabindra Bharati University; Ministry of Welfare, Govt. of India; International Rice Research Institute (IRRI); Department of Biotechnology (DBT); Indian Council of Agricultural Research; Indian Council of Medical Research; WBPCB; UNU/IAS, Tokeo; IGIDR; Calcutta University; R Systems International Ltd., Noida; Larsen & Turbo Ltd.; Reliance Ltd.; Mahindra & Mahindra Ltd.; Ahmedabad Food Corporation of India; Starlight Industries; Jaihind Engineering; ITC; Sky Tech Solutions; Robert Bosch; Balmer Lowrie; East India Pharmaceuticals Ltd.; Britannia Industries Ltd.; Coats of India. ISI has received **Rs.104.56 lakh** from these organizations. Government of India provided Plan and Non-Plan funding of **Rs.56.43 crore**, during 2003-04.

## **Seminars, Workshops, Conferences, Symposiums etc. Organised**

7.13 More than 80 seminars and workshops were conducted by ISI during 2003-04 on statistical themes.

## **Publications**

7.14 Sankhya, the Indian Journal of Statistics and the Official organ of the Indian Statistical Institute is now published in one series four times in a year in February, May, August and November. All the above issues of Sankhya, volume 65 (2003) were published during the year. Since its inception, eminent scholars all over the world have been contributing research articles for publication in Sankhya, one of the most prestigious and internationally renowned journal. During the year about **150** scientific papers were published and about **100** papers were accepted for publication in different journals of national and international importance.

## **Scientific Assignments Abroad**

7.15 In 2003-04, **seventy nine scientists** of the Institute visited a number of foreign countries either on invitation or under exchange programme to attend international seminars and conferences. Most of them presented scientific papers and delivered lectures in those seminars and conferences. Countries visited by ISI faculty members were USA, Norway, Berlin, Sweden, Singapore, UK, Switzerland, France, Portugal,

Korea, Italy, Germany, Canada, Australia, Nepal, China, Spain, Japan, Philippines, South Africa, Brazil, Netherlands, Vietnam, Peru, Belgium, Poland etc.

### **Visiting Scientists**

7.16 In 2003-04, **one hundred twenty seven** distinguished scientists from U.S.A., Germany, New Zealand, U.K., Bangladesh, Japan, France, Paris, Canada, New York, Italy, Iran etc. visited the Institute to attend various Workshop, Conferences, Seminars etc. and also to participate in collaborative research, teaching and other scientific activities of the Institute. Several scientists from Indian Academic Institutions also visited the Institute in connection with the same.

### **Recognition to ISI Scientists**

7.17 In appreciation and recognition of the high standard of research and scientific excellence maintained by the researchers of the Institute, several faculty members received laurels in the forms of Awards, Fellowship from organisations of national and international importance like ISCA, IEEE, INSA, etc. Several faculty members served as visiting scientist, honorary professors, Visiting Professors in various universities in US and Europe; Indian Council of Social Sciences Research (ICSSR); Indian National Science Academy etc. Besides, many faculty members were invited by national and international Institutes/bodies to act as chairman, member, chief editor, editor for their several committees/editorial board etc. Among those, some of the notable recognitions earned during 2003-04 are indicated below :

- \* Dr. Debashish Goswami has received the Junior Associateship of ICTP, Trieste, Italy. He is an Associate of Indian Academy of Sciences.
- \* Professor T.J. Rao continues to be Chairman, Governing Council of NSSO.
- \* Professor A. Sitaram was an Editor of the Proceedings of the Indian Academy of Sciences (Mathematics Sciences).
- \* Professor G. Misra and B. Bagchi were members of the Editorial Board of the Proceedings of the Indian Academy of Sciences (Mathematics Sciences).
- \* Professor M. Delampady and S. Ramasubramanian were Co-Editors of Sankhya.
- \* Professor B. Sury was a member of the Editorial Board of Resonance.
- \* Professor Siddhartha Gadgil was the Associate of the Indian Academy of Sciences.
- \* Professor Ashis Sen Gupta acted as Editor-in-Chief in Journal of Indian Society for Probability and Statistics; Guest Editor in Environmental and Ecological Statistics, Associate Editor in Journal of Statistical Planning and Inference, Journal of Statistics and its Applications, Journal of Indian Statistical Association

and Stochastic Models and its Applications; Academic Secretary, Forum for Interdisciplinary Mathematics.

- \* Professor B.B. Bhattacharya serves in the Editorial Board of the Journal of Circuits, Systems and Computers. He also serves as Chairman of the Advisory Committee for the Asian Test Symposium 2005, as Tutorial Chair for the International Conference on Computers and Devices for Communication 2003 and as a member of the Steering Committee for the international Conference on VLSI Design 2004.
- \* Professor Jayasree Duttagupta and Nabanita Das serve as Editors of the Mobility management in Wireless, Mobile and Ad hoc Networks of journal of microprocessors and Microsystems.
- \* Dr. U. Pal received outstanding Young Researcher Award from International Association of Pattern Recognition (IAPR) for significant work in the domain of Indian language optical Character Recognition.
- \* Professor S.K. Pal has been elected a Fellow of the International Association for Pattern Recognition (IAPR), USA for his contribution to Pattern Recognition and Image Processing using Soft Computing.
- \* Professor Partha P. Majumder has received the G.D. Birla Award for scientific research.
- \* Dr. B. Mohan Reddy has been elected the Secretary of the Indian Society of Human Genetics.
- \* Professor S. Sengupta has been invited by School of Public Health-WHO Collaborating Centre, Germany for an International collaboration for her original work on p53 polymorphism in cervix cancer.
- \* Professor Abhirup Sarkar received Panchanan Chakraborty Memorial Award for his contribution to Economics.
- \* Dr. Debaprasad Bandyopadhyay received Senior Fellowship from Central Institute of Indian Languages, Mysore Ministry of Human Resource Development.
- \* Professor V.K. Ramachandran has been a member of the State Planning Board, Government of West Bengal and the Council of the Institute of Development Studies. He is Chairman of State Land-use Board, Government of West Bengal.
- \* Professor Atis Dasgupta has been a member of the Heritage Commission of West Bengal and the Council of the Institute of Development Studies. He is a member of the State Advisory Committee for the compilation of the West Bengal District Gazetteers.