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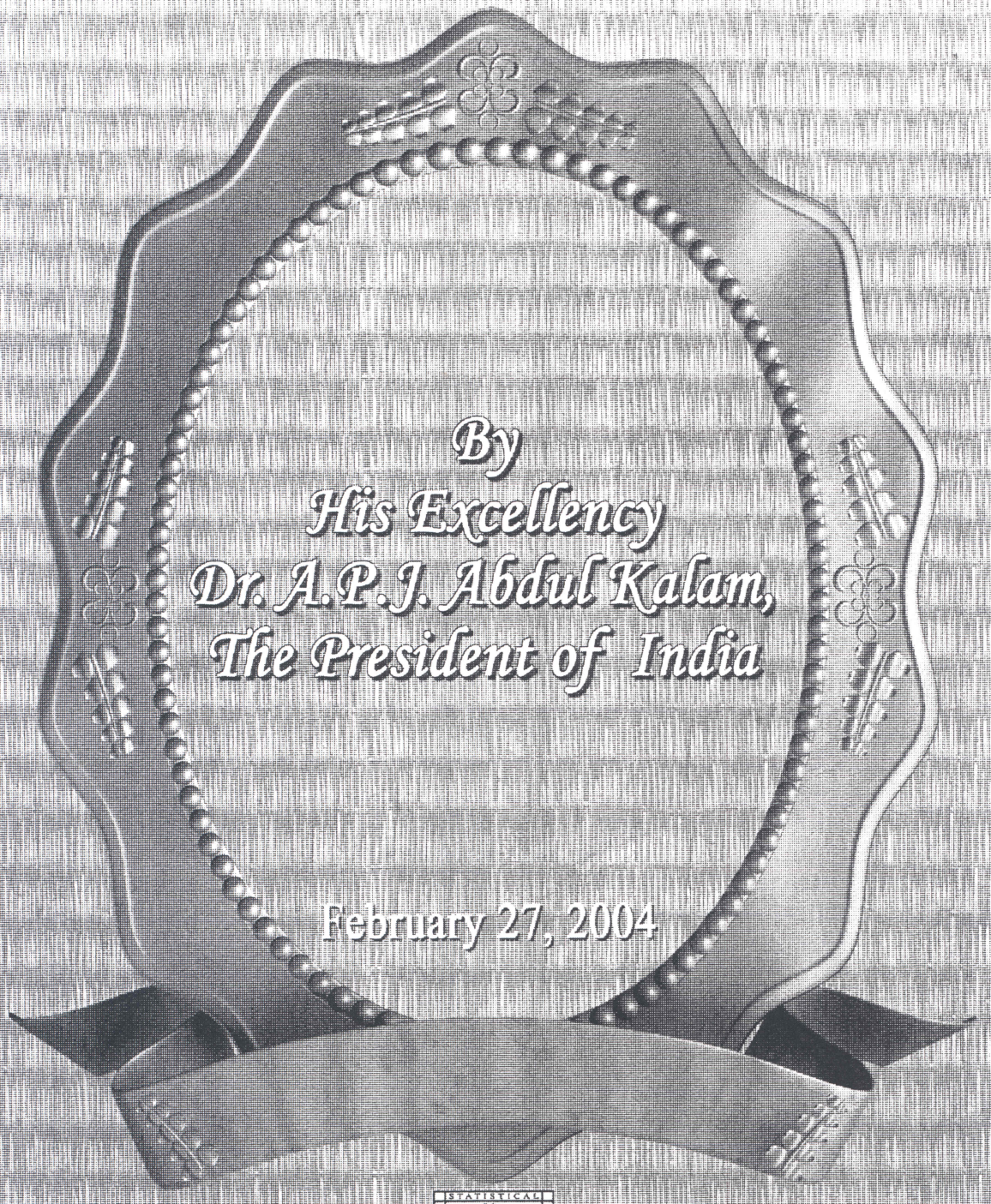

By
His Excellency
Dr. A.P.J. Abdul Kalam,
The President of India

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Indian Statistical Institute
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Statistics and its multi-dimensions

I am indeed delighted to participate in the 38th Convocation of the Indian Statistical Institute. I greet the President of the Institute Prof. M G K Menon, Director Dr. KB Sinha, distinguished Faculties & Guests, students and other members of ISI family. I congratulate the students for their excellent academic performance and the Faculty members for shaping the young minds. When I am in the midst of experts in statistics, I was thinking what thoughts I can share with you. I have selected the topic *"Statistics and its multi-dimensions"*.

Evaluation of System Reliability

Statisticians remind me of the quality and reliability groups of ISRO and DRDO. I used to ask the quality and reliability group to closely work with the sub-systems and integration teams while the launch vehicles and missiles were being prepared for the missions. They used to be active partners in all the static tests, Waiver Board, Failure Analysis Board, Launch Readiness Board, Launch Authorization Board and Post Flight Analysis Board of all missions. Based on their experience and the mathematical modeling of the system under test, I used to ask them about the theoretical reliability which they had worked out for a particular mission. Many times they used to say that the theoretical reliability was around 0.5 or 0.6. Though this was not considered to be fully adequate for 100% success in the mission, I used to consult them on how to improve the reliability factor. Based on the innovative improvements suggested, I used to give conditional clearance for the launch. The correlation between the prediction and the actual performance of the mission was excellent. The statisticians always exhibited an innate capability to improve the confidence from mission to mission based on the observations and knowledge gained from the designers. Whenever the experts in statistics participate the task or programme in the mission mode, their understanding of the interaction between the subsystems

increases. This enhanced understanding has helped the statisticians to evolve better models for predicting the reliability of the mission. The statisticians provide very useful performance data to the designers by providing silent support in all complex missions. ISI was an active partner in the evolution of reliability model. Today ISRO and DRDO have got a proven well-tested reliability model.

Cryptography opportunity for path breaking discoveries

The role played by statisticians and pure mathematicians in another important mission of DRDO is worth recalling. This has to do with our capacity building exercises in evaluating and analyzing cryptographic equipments for operational use. As most of you know, the crypt analysis problems are NP-hard (Non-Polynomial Hard) and are not easily amenable for simplistic mathematical modeling. Very often statisticians are called upon to build models based on continued observations of the time series signals with no a-priori knowledge. Cryptography, encryption and decryption are becoming very important need in the e-commerce dominated knowledge world. All our bank economic transaction and security information need highest order of encryption and decryption and the very important need, the many institutions in the country with partnership with R&D organizations and defence institutions has to evolve unbreakable Indian algorithms with provable security. We could also look for newer class of encryption algorithm from our ancient scriptures and languages. Because of your unique strengths in number theory, statistics and Indian languages to make path breaking discoveries of national importance in these areas.

Research Contributions

Indian Statistical Institute is known world over for its seminal research contributions to soft computing. Your work in learning systems, neural networks and Indian language technology including the development of OCRs is appreciated highly by the emerging community of Indian language based IT professionals particularly those who are aspiring to take the Indian language content on to the web in a freely accessible and browsable form.

In a large country like India making financial policies and taxation policies are very complex. This involves handling large volume

of data of uncertain nature and modeling on the basis of observed data. Similar are the issues related to modeling of an Indian weather. A nationally proven and validated model for economic dynamics for the country is the vital need. I do hope ISI would take this as a challenge worthy of pursuit and make useful contributions.

Pioneering work of Mahalanobis

One could say, that if Europe is the mother of the differential calculus based deterministic analysis; India could well be called the mother of statistics. When I think of the names in Statistics, I am immediately reminded of P C Mahalanobis who founded the Indian statistical Institute in December 1931 and persuaded many young physicists and mathematicians to join the institute.

Mahalanobis believed that statistics should be integral part of national planning. He was aware of the national problems and national resources. He took a keen interest and played a key role in formulating India's Second Five Year Plan based on the four-sector model developed by him. He made sectoral allocations for employment, capital investment and increment in national income and then split them into detailed targets. The need for planning in the initial stages of national development is still acknowledged and Mahalanobis's contribution to Indian national planning continues to be held in high esteem by economists. This Mahalanobis model must be revisited in the modern day digital economy, where the economy is dependent on the knowledge capital and small start-ups make up the large part of the economy.

Dr. C. R. Rao, one of this century's foremost statisticians graduated from Indian Statistical Institute (ISI), Calcutta just like most of you, who are graduating today. Your institute has the distinction of being among the first ones to be founded for the study of statistics in the world and had produced a brand of alumni who occupy the best positions in scientific research and policymaking. I am sure you would be feeling extremely happy to join such a band of distinguished alumni.

Statistics for Medicare

Now I would like to discuss some of the areas where statistics can be applied to determine a solution to long-standing issues. Recently, I was attending a conference of Cardiovascular Thoracic Surgeons at Delhi. In that conference it was observed that the occurrence of coronary artery diseases in India is taking place between the age group of 35 and 55, whereas in the western world, it generally occurs after 55 or 60. It is also found that the occurrence of cardiovascular cases is 4% in rural area as against the 10% found in big cities in India. Whereas the world statistics says that the incidence is only 3 to 4%. It is also reported that Indians are genetically three times more vulnerable to heart attacks wherever they are than Americans and Europeans. My Doctor friends say, Rheumatic heart disease, which leads to heart valve destruction, is peculiar to the Indian community. These are fertile areas where statistical experts can work and provide vital direction for seeking a corrective measure for this situation. I was told that the scientists of Indian Statistical Institute are concentrating on identifying genes and estimating their interactions with environmental parameters that underlie cardiovascular diseases. I would like the team to interact with renowned surgeons and cardiologists to generate reliable data for carrying out this study. I suggest you can discuss with Dr P Venugopal, Director, AIIMS, Dr. D. Prasada Rao, of CARE Hospital, Hyderabad and Dr. Shetty of Narayana Hrudayalaya, Bangalore and other experts in the field. Also, the team can take up the multi-dimensional problems associated with the disease apart from the genes. Based on the study results surgeons should be able to advice their clients on life style modification, preventive therapy and decide on screening techniques/frequency for early detection and remedy.

Simulation of mega projects

Another area of national importance where the statisticians can help is in the Inter-linking of river project. As you are aware, a Task Team has been constituted for evolving the plan of action including the ecological enhancement plan for executing the project. This mission will eliminate the periodical problem of drought and flood experienced in a number of river basins. This is an important mission from both water and power security. The task team is in the process of preparing the total plan for the nation. Indian Statistical Institute

can provide useful inputs on the macro-economic impact of the interlinking of river projects. Also they can validate the ecological enhancement plan through the study of existing terrain through the analysis of satellite pictures. This will be a very useful input for implementing this mega mission. Statistical model for the Interlinking of rivers connecting the rainfall and snow measurements and the ground porosity for the water run off model is a great challenge for the future of India. ISI need to engage itself in coming out with reliable solution for this problem in next few years.

Capacities for nation building

This Institute is the reservoir of the enlightened human resource for the nation. For enabling the youth coming out from the institute to participate in the national development, it is necessary for the institute to prepare the young to take up the challenging tasks ahead. For realizing the Vision 2020, the capacities required are: the capacity for research and inquiry, the capacity for Creativity and Innovation, particularly the creative transfer of knowledge, the capacity to use high technology and the capacity for Moral Leadership.

a. Research and enquiry: 21st century is about the management of all the knowledge and information we have generated and give value to it. We must give our youth, the skills with which they find a way through the sea of knowledge that we have created. Today, we have the ability, through technology, to really and truly teach ourselves and to become the life-long learners that any sustained economic and political development requires.

b. Creativity and innovation: We can best teach ourselves by teaching others. The management of knowledge in 21st century is beyond the capacity of individuals. The amount of information that we have is overwhelming and has exceeded the capacity of individuals. We must learn how to manage knowledge collectively. In other words we must not only teach ourselves, but also teach others.

c. Capacity to use of high technology: Every student should graduate to know how to use the latest technologies for aiding their learning process. The Institute should equip itself with adequate computing equipment, laboratory equipments, Internet facilities and

provide an environment for the students to enhance their learning ability.

d. Moral leadership: Moral leadership involves two aspects. First, it requires the ability to have compelling and powerful dreams or visions of human betterment. A state of things in which human beings could be better off in the future than they are now. Secondly, moral leadership requires a disposition to do the right thing and influence others also to do the right thing.

As you are aware we have in our nation 260 million people living below the poverty line. The nation has to lift them up. Today the GDP growth rate is about 6%; it has to be lifted up to 10% and to be sustained for several years. It is also to be noted that 700 million people out of our billion plus population live in six hundred thousand villages. To enable development of these 700 million people the nation is poised to undertake a new scheme called PURA (Providing Urban Amenities in Rural Areas).

Economic Connectivity for PURA

Providing Urban facilities in Rural Areas (PURA) consisting of four connectivities: physical, electronic, knowledge and there by leading to economic connectivity to enhance the prosperity of clusters of villages in the rural areas. The economic connectivity will generate a market and the production establishments for servicing the market. The PURA has all the dimensions to become a business enterprise, which has global dimensions but operating in every nook and corner of our country. The PURA entrepreneur has to have the skill for evolving a business plan with banks and also create infrastructural support such as educational institutions, health centres and small scale industries, transportation services, tele-education, tele-medicine, e-governance services in the region integrating with the governmental rural development schemes such as road, communication and transport and also with national and global markets to sell the products and services.

PURA Enterprise

The small and medium industry enterprises in India have experience in managing the small and medium scale industries of different types in various regions. This sector is widespread in the country and is a promising candidate for taking the leadership and managing the PURA complexes in an integrated way. Also major businesses in India with wide spread rural services have an experience of maintaining large rural-urban networks. PURA enterprises can undertake management of schools, health care units, vocational training centres, chilling plants, silos and building a market, building of local industrial / ICT parks, tourism services, banking system and the regional business or industrial units. A new management style has to emerge for managing such type of PURA enterprises. This new PURA enterprise needs partnership from the bank, educational institutions, Government and the private entrepreneurs. The management system should have the flexibility to be competitive and the country has to experiment several models depending on local needs.

Business Plan for PURA

Each PURA depending upon the region will cost between Rs.100-200 crores. After initial short term employment during construction etc., we may have to plan for initiating actions for providing regular employment opportunities for 3000 employees. If the industrial / ICT parks are marketed well, they can generate employment opportunities in service and support sector for about 10000 people. This is one way of reducing the employment gap leading to upliftment of the 260 million people living below the poverty line and also to provide better jobs for many millions who are technically above poverty line, but poor by many other standards.

In brief, we should generate the business plan for PURA and evolve methodologies for creating a model that would:

- create a data base of core competencies and comparative advantages in the chosen region.
- estimate the cost of implementing PURA

- measures of quantitatively establishing the economic prosperity of people before and after PURA is implemented
- economic returns and self sustainability
- marketing methods for making the PURA self-sustaining and to attract investments
- identify key business persons, public persons and others who can manage PURA successfully and also bring in investments.

I am sure the graduates and postgraduates of the Indian Statistical Institute will be in a position to develop simulated business plan, which will enable enterprises towards making investment decisions in PURA and make PURA a socially relevant and economically feasible enterprise. Also, you may study what is the potential business, rural industrial growth; and the clean green industrial ventures are possible in the rural clusters of our country in view of the national and international market requirements and its statistical model study. Your statistics will certainly give a proper and viable input for the better planning in providing economic connectivity in the PURA Cluster. I am confident that you can play a very crucial role towards the rural transformation process set by PURA.

Role of statistics in a Society

Statistics is an area where there are many challenging problems waiting to be solved. Particularly, for a country like India, where the dynamics of demography is of paramount importance.

In the planet earth, India is the only democratic nation having a population of billion people. The population growth rate is very high in India it is more than 3 per 1000, whereas the well-balanced society needs to have 1.1 per 1000. In such a situation, the demography has a very important role and it needs continuous monitoring and the possible solution, that has to come from a mathematical statistical simulated model, validated in real-time periodically. The mathematical challenge is indeed really complex since diverse democratic variants are unique to our population.

Spotting the unspottable

Solving such problems through statistical modeling requires a large number of young brilliant minds to take up research in statistics and make it as a profession and way of living. For this to happen, the faculty members have an important role to play, they not only must encourage the identified talents in the students, but also be able to spot the brilliant Ramanujan's in the nascent stage itself, much before any one else in the world spots them. And these could be from unknown corners of the country and at times a diamond waiting to be cut and made into a jewel.

I want to narrate a story. A young man, Loveligen, from a remote area of Kerala, who could not complete PUC, wrote to me saying that he has discovered a new mathematical theory and he would like to talk to me. I saw in the letter that the boy was very sincere. Since he has written to me, I thought our specialist team could study his work and direct him to the right type of researchers. I called this boy to Delhi for a few days. What surprised us was that he had arrived at part of the equations of the Ramanujan's number theory, which this boy was not at all aware of. He had discovered something and added some new points to it and the result is new. To a great extent the achievements in the field of mathematics generally seem to come out of a desire to look into the beautiful aspects of nature, including natural phenomena such as the star studded skies, which have always interested the astronomers from time immemorial. An additional contributory factor seems to be an inherent drive towards recognition of patterns even if it were in the sense of mathematical sequences or series.

It is interesting to note that Loveligen has currently delved into the equally exciting topic of power sequences and series. What I felt was that he needed a good mathematical education or a patronage of a good mathematics teacher. It is like having Prof. Hardy for Ramanujan, the mathematics genius to come. I asked this boy, why he didn't meet a mathematics teacher. He said, meeting a mathematics teacher is an expedition. He says, it is below their dignity to meet somebody who is not even a graduate. How do we promote this kind of young and enthusiastic minds? Can our teachers and philanthropists or the social activists spot these buds to blossom? Those who spot such talents and make them blossom will themselves

be a different kind of a flower as described in the Bhagwad Gita: "*See the flower, how generously it distributes its perfume and its honey. It gives to all, gives freely of its love. When its work is done, it falls away quietly. Try to be like the flower unassuming despite all its qualities*". What a beautiful message for all generations of this Nation.

I strongly urge the graduating students that they will take upon themselves the task of identifying at least each one of you, reach one, who cannot dream to have education even if they are brilliant. Because, only a burning candle can light another.

Conclusion: Message for the youth for the year 2004

For the year 2004, I have a message for the youth of our country. All the youth should have indomitable spirit. Indomitable spirit has two components. First you should have an aim and work for it. Second, while working you will definitely encounter some problems. In those circumstances, do not allow problems to become your master, you should become master of the problems, defeat them and succeed. Fortunately, our nation has a great resource of young population. Ignited minds of the young are the greatest resource compared to any resource on the earth, under the earth and above the earth. When ignited minds work and perform with indomitable spirit, prosperous, happy and safe India is assured.

I wish you all success.