P C Mahalanobis : A Statistical Legacy in Economic Planning and Data Science

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Abstract: *Prasanta Chandra Mahalanobis (1893-1972) was an Indian statistician and economist who made significant contributions to statistical theory, economic planning and analysis of large-scale data. His work on the Mahalanobis Distance continues to be at the core of Multivariate analysis with applications from machine learning, outlier detection and pattern recognition. Mahalanobis Model was instrumental in India's economic planning and his work towards large scale sample surveys brought a revolutionary change in the process of data collection. In the context of UGC's focus on Indian Knowledge System (IKS), going through Mahalanobis' work brings forth India's intellectual legacy and how well they remain applicable in contemporary scientific and policy making paradigms. His work represents a reconciliation of classical Indian mathematical heritage and worldwide statistical innovation, to construct data-driven governance and inter-disciplinary education. This paper continues the tradition in Statistics and economics of illustrating the enduring relevance of his method to this day in AI, economic prediction and public policy.*

Keywords: Economic planning, Mahalanobis model, Mahalanobis distance, Multivariate statistics, Indian Knowledge System (IKS), Statistical sampling, Machine learning Applications, Data Driven Governance

I. INTRODUCTION

Prasanta Chandra Mahalanobis is one of the world's finest statisticians and economic planners. His work on multivariate analysis, large sample surveys, and statistical modelling has influenced India's developmental policy and disseminated their applications across the globe through statistical practice. His work at the mathematics-statistics-economics interface yielded a data-driven approach to policy-making that has far-reaching implications even today when big data analytics and artificial intelligence prevail.

II. EARLY LIFE AND EDUCATION

Born on June 29, 1893, in Kolkata, British India, Mahalanobis hailed from a distinguished Bengali family. But his family members are now at "Panchasar" in Bengladesh. His father, Probodhchandra , was the third son of Guru's five children. Mahalanobis completed his early education at the Brahmo Boys School before enrolling at the Presidency College, where he studied physics and graduated in 1912. Later, he moved to England to pursue further studies at the University of Cambridge and he passed 'triposes' which is a degree course provided by the University of Cambridge. It was during his time at Cambridge that Mahalanobis developed an interest in statistics, which eventually became his primary field of work.

. There, his interest in statistics enhanced, and he developed multivariate statistical methods. His interest was not statistics by itself; he was a staunch supporter of an integrated system of knowledge encompassing subjects such as physics, mathematics, and even astrology, a learning approach which was promoted by the Indian Knowledge System (IKS) philosophy.

III. INFLUENCE OF INDIAN KNOWLEDGE SYSTEM (IKS) ON MAHALANOBIS' WORK

Indian Knowledge System (IKS) focuses on the convergence of various streams of knowledge, a task that challenged Mahalanobis' research and innovations in a very penetrative manner. UGC guidelines focus on the use of IKS in inter-

disciplinary research, self-reliance, and innovation, all of which are core to Mahalanobis' approach. It can be criticized and argued on the following lines:

- Interdisciplinary Learning: Mahalanobis held the view that interdisciplinary learning augments statistical research. His incorporation of physics, mathematics, and social sciences into statistical techniques shows IKS's focus on complete learning.
- Scientific and Indigenous Knowledge Integration: His creation of large-scale sample surveys combined Western statistical analysis with Indian census-practices and exhibits the syncretism between indigenous and external knowledge typical of IKS.
- Economic Self-Reliance: Inspired by the native spirit of self-reliance, Mahalanobis' economic philosophy was also focused on self-sustained industrial growth complementing IKS goals of supporting national self-reliance.
- Empirical and Analytical Solutions: As was the method of ancient Indian thinkers who relied on empirical data and analytical solutions in finding answers, Mahalanobis also relied on diligent data collection and statistical validation.

Through the use of IKS principles, Mahalanobis transformed Indian statistics but made it indigenous in intellectual traditions. Through his strategy, self-reliant economic policy was created, one of the elements that still have significant implication to debates of sustainable development and nation-building in the modern period.

IV. MAHALANOBIS DISTANCE AND MULTIVARIATE ANALYSIS

One of the most significant contributions made by Mahalanobis is the Mahalanobis Distance, which he developed in 1936. It is a statistical distance to find the distance between a point and a distribution in multivariate space. It is not the same as Euclidean distance since it is correlation-sensitive and thus is extremely useful in a large number of applications such as machine learning, artificial intelligence, pattern recognition, and outlier detection.

Mahalanobis Distance is used extensively in industry quality control, biometric identification, finance, and other applications. It is used in machine learning for predictive modeling, classification, and clustering. The measure is used extensively in dimensionality reduction of high-dimensional data sets and outlier detection and therefore can be said to be one of the most popular tools in contemporary data science.

V. LARGE-SCALE SAMPLE SURVEYS AND DATA COLLECTION TECHNIQUES

Mahalanobis transformed large-sample surveys, with greater accuracy and the economy of data collection manifold. Complete enumeration of data prior to his work was usually tedious and expensive. Through his pioneering application of methods of random sampling, he achieved a revolutionary leap in census counting and socio-economic surveys.

One of his efforts in this direction was that in 1950 he conducted the National Sample Survey (NSS), which yielded valuable statistics regarding demographic developments, agricultural production, industrial production, and socio-economic conditions. His approach to crop production estimation with a crop-cutting technique set new standards for survey research, and this subsequently encouraged international organizations like the United Nations and World Bank to adopt the same.

VI. THE MAHALANOBIS MODEL AND ECONOMIC PLANNING

Mahalanobis played a central role in India's Second Five-Year Plan (1956-1961) where he derived the renowned Mahalanobis Model of economic growth. Capital industries and heavy industry were the fundamental pillars of his model due to the fact that the sources of growth were these. Being in the backdrop of Soviet-type central planning, he was of the belief that investing in industries would usher long-term economic safety and decrease imports.

The Mahalanobis Model focused its attention on investment in the government sector in steel, machine tools, and infrastructure as the basis for Indian industrialization. Nevertheless, it has also been faulted for not paying attention to agriculture and small-scale industries, and thus leaving food production to suffer from supply bottlenecks. Notwithstanding such shortcomings, the model is still a standard for development economics and industrial policy.

VII. LEGACY AND RECOGNITION

For his contributions to statistics and economic planning, Mahalanobis received several prestigious honours, including the Padma Vibhushan, one of India's highest civilian awards.

• Fellow of the Indian Academy of Sciences (FASc, 1935) • Fellow of the Indian National Science Academy (FNA, 1935) • Officer of the Order of the British Empire (Civil Division), 1942 New Year Honours list • Weldon Memorial Prize from the University of Oxford (1944) • Fellow of the Royal Society, London (1945) • President of Indian Science Congress (1950) • Fellow of the Econometric Society, US (1951) • Fellow of the Pakistan Statistical Association (1952) • Honorary Fellow of the Royal Statistical Society, UK (1954) • Sir DeviprasadSarvadhikari Gold Medal (1957) • Foreign member of the Academy of Sciences of the USSR (1958) • Honorary Fellow of King's College, Cambridge (1959) • Fellow of the American Statistical Association (1961) •DurgaprasadKhaitan Gold Medal (1961) •Desikottam by VisvaBharati University (1961) • Padma Vibhushan (1968) •SrinivasaRamanujan Gold Medal (1968)

His work continues to influence modern statistical research. In 1933 he started a publication named as 'Sankhya'. More than just a publication , it is an asset to the field of statistics.

The government of India decided in 2006 to celebrate his birthday, 29 June, as "National Statistical Day". On the occasion of his 125th birth anniversary on 29 June 2018, Indian Vice-President M Venkaiah Naidu released a commemorative coin at a programme at ISI, Kolkata.

VIII. CONCLUSION

P.C. Mahalanobis' contributions to statistical science, economic planning, and institution building remain invaluable. His work in multivariate analysis, large sample surveys, and economic modelling continues to be relevant in today's research and policy-making. His syncretic epistemology of knowledge gaining strength from various disciplines reflects the salience of Indian Knowledge Systems (IKS) for modern scientific self-reflection. With the global emphasis on data-driven policy-making and Artificial Intelligence-powered analytics, Mahalanobis' work as a pathfinder of statistical science and economic planning continues to be a gigantic source of inspiration in policy-making and policy research globally.

REFERENCES

[1], Basu, A. "P. C. Mahalanobis: The Scientist and His Contributions to Statistics." Sankhya: The Indian Journal of Statistics, vol. 62, no. 3, 2000, pp. 1-15.

[2[. Bhartiya, Aditya Kumar, and Ashwini Kumar Nagpal. "P.C. Mahalanobis:MathematicalContributions to Statistics." International Advance Journal of Engineering, Science and Management, vol. 16, issue 1, July-December 2021, pp. 111-114.

[3]. Chattopadhyay, A. K. Prasanta Chandra Mahalanobis: Pioneer of Indian Statistics. Oxford University Press, 2011.

[4]. Mahalanobis, P. C. "Historical Note on the Indian Statistical Institute." Sankhya: The Indian Journal of Statistics, vol. 1, no. 1, 1933, pp. 1-5.

[5] .Rao, C. R. Statistics and Truth: Putting Chance to Work. World Scientific Publishing, 1997.

[6].Rudra, Ashok. Prasanta Chandra Mahalanobis: A Biography. Oxford University Press, 1996.

[7].Sen, S. "Mahalanobis and the National Sample Survey: A Historical Perspective." Economic and Political Weekly, vol. 43, no. 45, 2008, pp. 77-85.

[8].United Nations. P.C. Mahalanobis' Contributions to World Statistical Systems. UN Publications, 1990.