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SANKHYĀ

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EDITORIAL.

Those of us who are actively engaged in starting this journal are doing so because of our interest in statistics and our belief that a journal devoted to statistics will be useful in India.

We shall interpret the scope of statistics in a catholic spirit. In its old sense statistics is an ancient subject. The numbering of the people and the collection of information regarding the resources of a country must have been in existence from the earliest times. The Egyptians, the Babylonians and the Romans preserved records of the resources of the state.

In India we have clear evidence that administrative statistics had reached a high state of organization before 300 B. C. In the Arthaśāstra of Kautilya it is enjoined that villages shall be brought "under one or another of the following heads:—Villages which are exempted from taxation (pariháraka) ; those that supply soldiers (áyudhíya), those that pay their taxes in the form of grains, cattle, gold (hiraṇya), or raw material (kupya) ; and those that supply free labour (vishṭi), and dairy produce in lieu of taxes (karapratikara)."

Among the duties of the Gopa, the village accountant, it is distinctly mentioned that "by setting up boundaries to villages, by numbering plots of grounds as cultivated, uncultivated, plains, wet lands, gardens, vegetable gardens, fences (váta), forests, altars, temples of gods, irrigation works, cremation grounds, feeding houses (sattra), places where water is freely supplied to travellers (prapá), places of pilgrimage, pasture grounds and roads, and thereby fixing the boundaries of various villages, of fields, of forests, and of roads, he shall register gifts, sales, charities, and remission of taxes regarding fields."

"Also having numbered the houses as taxpaying or non-taxpaying, he shall not only register the total number of inhabitants of all the four castes in each village, but also keep an account of the exact number of cultivators, cow-herds, merchants, artizans, labourers, slaves, and biped and quadruped animals, fixing at the same time the amount of gold, free labour, toll, and fines that can be collected from it (each house)."[1]

In the classic period of Sanskrit culture there are numerous references to detailed statistics of various kinds in inscriptions as well as in technical treatises. In more recent

[1] Artha-śāstra of Kautilya translated by R. Shamasastry (Mysore Government Press, Bangalore, 1915), Ch. XXXV, pp. 178-179. The date of the Artha-śāstra is placed between B. C. 321 and 300. (Preface, p. vi).

times, under the Mahomedan rulers of India, we find descriptive statistics occupying a very important place. The most well known compilation of this period is the Ain-i-Akbari, the great administrative and statistical survey of India under Emperor Akbar which was completed by his minister Abul Fazl in 1596-97 A. D. It contains a wealth of information regarding a great empire "faithfully and minutely recorded in their smallest detail, with such an array of facts illustrative of its extent, resources, condition, population, industry, and wealth as the abundant material from official sources could furnish."[2]

In Europe statistics had vague beginnings in the Middle Ages, but it became a serious subject of study with the rise of the modern states in the 17th and 18th centuries. The growth of economics gave it added importance; in fact, until recently, statistics continued to be almost exclusively associated with economic studies. The Journal of the Royal Statistical Society of Great Britain and similar journals in other countries represented this tradition for a long time.

On the mathematical side the theory of probability had developed practically contemporaneously with economic and official statistics, and yet the two movements were entirely unrelated for a long time. The theory of errors based on the normal distribution was developed by Laplace, Gauss and other mathematicians, and had at first its chief applications in the reduction of observations in astronomy and the physical sciences. Its scope was extended to anthropology and other subjects by Quetelet in the middle of the last century, and a little later the idea of correlation was discovered by Galton and was immediately used in the biological sciences with most fruitful results.

In one sense, however, the history of modern statistics may be said to have begun from Karl Pearson's work on the distribution of χ^2 in 1900. The Chi-square test supplied for the first time a tool by which the significance of the agreement or discrepancy between theoretical expectations and actual observations could be judged with precision. It also served as the starting point for later developments in the study of sampling distributions which characterize recent researches in statistics. It was not, therefore, accidental that *Biometrika* was founded by Pearson in 1901 within a year of the discovery of the χ^2-test. Although the scope of *Biometrika* was deliberately restricted to biological problems, it helped materially in creating the new statistics of to-day under the leadership of its editor.

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[2] English translation by H. Blochmann (Vol. I, 1873) and H. S. Jarrett (Vol. II, 1891; Vol. III, 1894) published by the Asiatic Society of Bengal, Vol. II, p. vii.

I shall give a random selection of some of the statistics recorded by Abdul Fazl. He gives the area, revenue valuation, strength of army and other details for about 15 *subahs* (provinces) comprising over 130 *sarkars* (districts) and over 3000 *mahals* (townships and sub-divisions) extending from Assam and Arakan to Afganistan. He gives the average yield of 31 crops for 3 different classes of land; annual records of rates based on the yield and price of 50 crops in 7 *subahs* (provinces) extending over 19 years (1560-1 to 1578-79 A.D.); daily wages of men employed in the army and the navy, labourers of all kinds, workers in stables, etc.; average prices of 44 kinds of grains and cereals, 38 vegetables, 21 meats and games, 8 milk produces, oils, and sugars, 16 spices, 34 pickles, 92 fruits, 34 perfumes, 24 brocades, 39 silks, 30 cotton cloths, 26 woollen stuffs, 77 weapons and accessories, 12 falcons, elephants, horses, camels, bulls and cows, deer, precious stones, 30 building materials; weights of 72 kinds of wood, etc.

It is no wonder that speaking of Abdul Fazl, Jarrett has remarked (II, p. v), that "regarded as a statistician, no details from the revenues of a province to the cost of a pine-apple, from the organisation of an army and the grades and duties of nobility to the shape of a candlestick and the price of curry-comb, are beyond his microscopic and patient investigation."

The work of "Student" on small samples in 1908 and its subsequent developments in the hands of R. A. Fisher and others further extended the scope of statistics. After nearly one hundred years Quetelet's idea of statistics as a general method of research was thus realised in practice, and when *Metron* was started as an international review of statistics by Gini in Italy in 1920, this fact was openly recognised in the introductory programme.*

We shall try to keep before us this comprehensive idea of the scope of statistics. We are convinced that statistics represents a fundamental method of analysis of data in the mass which is applicable to any science of observation, and we feel that it is desirable to emphasize this essential unity in the methodology of statistics.

We believe that the idea underlying this integral concept of statistics finds adequate expression in the ancient Indian word *sankhyā*. In Sanskrit the usual meaning is 'number', but the original root meaning was 'determinate knowledge'.[3] In the Atharva-Veda a derivative form *sankhyātā* occurs both in the sense of 'well-known' as well as 'numbered'.[4] The Lexicons give both meanings. Amara-koṣa gives *sankhyā=vicāraṇā* (deliberation, analysis) as well as 'number'; also *sankhyāvān=paṇḍitaḥ* (wise, learned).[5]

The same dual sense is attached to its derivative form *Sānkhya*[6] which is the name of the most famous analytic philosophy of ancient India. The name of the philosophical system is explained in both ways: as a philosophy based essentially on enumeration of the categories beginning with Nature or Root Cause. Or else a philosophy by which is

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*The scope of statistics was definitely extended to "mathematical, astronomical, technical, physical, chemical, actuarial, economic and financial, psychological, historical, legal, physiological and pathological, hygienic and medical, biological, genetic and eugenic, zoological, botanical, and agricultural publications" (p. 11).

[3] The word can be written *saṁkhyā* or in a simpler form as *sankhyā*, the sound of *anusvāra* (nasal glide following a vowel) assimilating with the following sound of *k* and becoming a velar nasal (like *ng* in English *sing*). The simpler spelling also indicates the current pronunciation (like *sung-khi-áh*).

The word is derived from *khyā* ('to perceive, view'; 'to be known', 'to make well-known' in Monier Williams's Dictionary). The root meaning is 'determinate knowledge', 'deliberation' or 'whatever helps us in obtaining determinate knowledge' according as the *kṛt* suffix is taken in the active or instrumental form. From the latter phase is derived the technical meaning of 'number'.

[4] Atharva-Veda, 4.25.2. It also occurs in 4.16.5 and 12.3.28.

Winterintz after a full discussion of the date of the Vedic age says "we shall probably have to date the beginning of this development about 2000 or 2500 B.C., and the end of it between 750 and 500 B.C." *History of Sanskrit Literature* (English Translation, Calcutta University, 1927), Vol. I, p. 310. While the present form of the Atharva-Veda is believed to be later than that of the Rg-Veda, much of its material is considered to be as old as, if not older than, many portions of the Rg-Veda. (Winternitz, p. 127). The word *sankhyā* is in common use in the sense of number in the time of Pāṇini.

[5] Amara-koṣa, 1.4.2 (*dhīvarga*). *'carcā sankhyā vichāranā'* (deliberation, reasoning, investigation). Also 2.7.5. (*Brahma-varga*) *"sankhyāvān paṇḍitaḥ."*

Monier Williams gives 'number, numeration; deliberation, reasoning, reflection; reason, intellect, understanding' under *sankhyā*.

[6] It is interesting to observe that the *Sānkhya* teaches differentiation between spirit (*purusa*) and matter (*prakṛti*), plurality of souls, independence and eternity of matter, and explains creation as an evolutionary unfolding of the world from original matter. (Winternitz, p. 434).

revealed the adequate knowledge of reality.[7] The root meaning is also met with in the Mahābhārata in the Gītā[8] portion where the *Sānkhya* system of philosophy is classified with the Vedānta as being based on *jñāna* (or intellectual cognition) as distinguished from the Yoga systems. Śrīdhara in his commentary on the Gītā explains *Sānkhya* as *samyag-jñāna*, that is, 'proper cognition' or 'adequate knowledge.'

The history of the word *sankhyā* shows the intimate connexion which has existed for more than 3000 years in the Indian mind between 'adequate knowledge' and 'number.' As we interpret it, the fundamental aim of statistics is to give determinate and adequate knowledge of reality with the help of numbers and numerical analysis. The ancient Indian word *Sankhyā* embodies the same idea, and this is why we have chosen this name for the Indian Journal of Statistics.

The spirit and outlook of *Sankhyā* will be universal, but its form and content must necessarily be, to some extent, regional. We shall keep the special needs of India in view without, however, restricting the scope of the journal in any way. We shall naturally devote closer attention to the collection and analysis of data relating to India, but we shall try to study all Indian questions in relation to world problems.

A research journal serves that narrow borderland which separates the known from the unknown, and it is not always possible to see clearly the lines of future developments. We shall, therefore, invite papers of all kinds appraising them only on the basis of observational accuracy and logical reasoning. We shall publish carefully collected statistical materials irrespective of the subject even if they have not received any analytic treatment. We shall pay special attention to developments of the mathematical theory of statistics, and include abstracts and expositions of important papers published elsewhere. We shall try to help statistical researches on co-operative lines by bringing workers in different parts of India in contact, and by providing a medium for exchange of ideas. Bibliographies of Indian statistical publications, numerical tables tending to reduce the labour of computation, book reviews, and notes and comments on current topics are some of the ways in which we shall try to make *Sankhyā* useful to statistical workers in India. Knowing that our resources are small we shall seek guidance and help from other countries, and we shall welcome and thankfully receive papers from abroad.

The study of modern statistical methods is in its infancy in our country, and we do not expect to be able to achieve immediate results. We shall be satisfied if we can help by our humble efforts to lay the foundations for future work.

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[7] In Vācaspatya we have *'mūla-prakṛtyādi-padārthānām gaṇanā'* ('the enumeration of the categories beginning with Nature, the Root Cause'). Monier Williams gives 'relating to number or calculation; enumeration, deliberating, reasoning; rational, discriminative' under *sānkhya*.

In the commentaries *Sānkhyā* is usually derived as *'samyak khyāyate vastutatvam anayā* ('by which is revealed fully the essence or truth of reality.')

Fitz-Edward Hall (*Sānkhya-Sāra*, Bibliotheca Indica, Asiatic Society of Bengal, 1862) discusses the dual sense, and quotes on p. 3, Dr. Röer in support: "The term *Sānkhya* has two meanings, enumeration and investigation." (*Lecture on the Sānkhya Philosophy*, p. 8).

The dual significance of the word *sānkhya* is the subject of a pun in the opening couplet of Bhāskarācārya's *Bīja-gaṇita*, the well-known treatise on Algebra.

[8] Bhavavad-Gītā, 2.39. It is usually placed in the early centuries A. D. (Winternitz, p. 438).

INDIAN STATISTICAL INSTITUTE

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II. The objects of the Society shall be:—

(1) To promote the study of Statistics both pure and applied and allied subjects.

(2) To provide for research and instruction for the advancement of the study and dissemination of knowledge of Statistics and allied subjects.

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IV. The membership of the Institute and its constituent bodies shall be open to all persons irrespective of sex, nationality, race, creed or class.

V. The Institute shall not distribute any part of its income or profit as dividend, gift, or bonus or in any other way among its members, provided nevertheless that office-bearers, workers, and other employees shall not be debarred from receiving remuneration or participating in grants because of their also being members of the Institute.

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