fear of competition as far as gemstones were concerned! Far from becoming rich, the GE inventors Bundy, Hall, Strong and Wentorf, each received a princely $25 savings bond as bonus for their breakthrough. Tracy Hall, bitter that his key contributions were so little recognized, soon left GE for a university, where he was to make a mark with his unique tetrahedral anvil cell. Hazen suggests that with proper publicity and promotion by GE, the first synthesis of diamond was worth a Nobel Prize.

GE started a separate division for manufacture of industrial diamonds, reaching a capacity of 1500 pounds (3.5 million carats) by 1959, at $2 per carat. Through untiring effort, Strong and Wentorf learnt to make perfect crystals as large as one carat. However by Hazen's admission, these will hardly make a dent in the market for gems, as they take very long to grow and the giant presses are too expensive to run. De Beers was also finally successful in diamond synthesis, but lost their protracted patent suits against GE. Nevertheless they set up their own manufacturing plants in Ireland.

What of recent developments? Man can sometimes score over nature. Diamond is pure carbon, some trace impurities imparting characteristic colours. Carbon has an atomic mass of 12, but natural carbon contains a small percentage of the isotope with mass 13. It has now been possible to grow diamond crystals containing exclusively carbon 12 atoms. These are called isotopically pure (isopure) diamonds and have some unique properties. For example, their thermal conductivity is about 50% higher than that of natural diamond. It is not commonly known that diamond, while an excellent electrical insulator, is a better conductor of heat than copper. This is another striking property which has been exploited for heat sinks of sophisticated semiconductor devices such as lasers. These diamond crystals are of course not gems, but of the industrial variety.

Fine-grain diamond suitable for abrasives are now being prepared by explosive technique, but recently there has been an upsurge of interest in preparing diamond films by relatively low-cost techniques. It is known that plasmas contain ions and electrons with high energies, which is equivalent to high temperatures. The Russians led by Derjaguin, had been toying with such alternative plasma techniques using chemical vapour deposition from methane – common marsh gas. Their attempts met with success so that microcrystalline films could be prepared on a variety of substrates kept at high temperature. This technique still remains an incompletely understood art, but holds the promise of laying down semiconducting films for diamond devices which could be useful at high temperatures, but can never hope to replace silicon.

There is an Indian angle to this – one of the pioneer workers in high pressure synthesis has been Rustom Roy of Pennsylvania State University. His study of phase diagrams of silica and other minerals are classics in the literature, as mentioned by Hazen. It was he who alerted the US community to the Russian work on plasma deposition of diamond. Hazen however, misses out on C. V. Raman's pioneering studies on diamonds, which have become just as important as Braggs' X-ray diffraction. In fact, it is the Raman spectrum of films that is universally used as the signature to distinguish diamond from diamond-like or amorphous carbon. Also, strangely absent is any mention of the Kohinoor, about which an entire section could have been written. There is also no explicit discussion of the different types of diamond – Types I, IIa and IIb, nor what constitutes 'American diamond' – zirconium silicate. Notwithstanding these omissions, Hazen has written an enthralling book that reveals the human aspects underlying exploration and innovation in a fascinating field which is off the beaten track. It weaves stories of failure and success, intuition and doggedness, to give a flavour of what research at the frontiers is all about.

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Science and Technology Data Book-2000. DST, Ministry of Science and Technology, Govt of India, New Delhi. 83 pp. Price not mentioned.

While assessing the content and presentation of the book under review, it is useful to trace the need, relevance and compulsions leading to the preparations of such data books.

Over the past three decades, there has been a growing need in India for an information system and database on science and technology statistics, popularly called 'Science Statistics'. Science statistics is defined as a field of statistics dealing with the quantitative measurement of the volume and structure of scientific and technological activities of a given country. It provides a conceptual framework wherein information is organized with the aim of measuring, analysing and evaluating a set of variables relevant to science policy making. Policy makers, particularly those concerned about planning, implementation and management of science, besides science policy researchers, felt the need for comprehensive information not only on the use of input resources (mainly human and financial) and infrastructure available, but also on the output of such activities measured in terms of increased productivity and economic growth, new products and processes and their large-scale diffusion and impact on society, such as economic growth measured by increased value added and trade in technology-intensive products and growth in scientific activity by increased publication count and citation index. Such information could be useful for undertaking cost–benefit analysis and other economic studies as well as efficient programming, planning and budgeting, and to compare the national efforts with those of other countries.

With the growing awareness of these needs, a number of countries including India have started data collection on scientific and technological activities (STA) which cover Research and Experimental Development (R&D), Scientific and Technological Education and Training at broadly third level (STET), and Scientific and Technological Services (STS). Over time, the statistics on S&T has expanded by not only covering the human and financial resources deployed, but also covering data on education of S&T personnel, scientific services and S&T activities related to production, design, quality control, patents, foreign collaboration and so on.

A need was felt in India since independence, for establishing a database for resources input to and output from S&T activities, but it assumed seriousness since the beginning of the 1970s. In fact, since 1976 (when the author of this

review took charge of the Science and Technology Statistics Division from 1976 to 1995, redesignated later as National Science and Technology Management Information System (NSTMIS) Division), the Department of Science and Technology (DST), Government of India has been conducting biennial national survey to collect data on S&T activities from central (Federal), state (Provincial) and industrial sectors, besides collecting data on relevant economic and social parameters from secondary sources. Such data collected are processed, compiled, tabulated and analytical reports are published on time, at regular intervals. The two most widely used reports are 'Research and Development Statistics' and 'Research and Development in Indus
These reports are widely disseminated in India and abroad. The latest reports available are for the year 1996–97 according to information available with the author. It may be mentioned that India is one among the very few countries in the world to publish such science statistics reports regularly.

A need was felt that the S&T statistics data pertaining to a particular year alone, though may be useful, will not bring out the trend in the growth or otherwise of S&T in the country and therefore these data will have to be converted into science indicators. Science indicators, both quantitative and qualitative, deal with the many facets/characteristics of organized S&T, accompanied by trend analysis and interpretations. The National Science Board, USA submits to the President of USA, a biennial Science and Engineering Indicators Report prepared by The National Science Foundation, USA. This is the only country preparing such comprehensive reports on a regular basis. In the recent past, some countries like Japan and China have started this exercise and India is also making efforts towards this end. It may be mentioned that Japan prepares a White Paper on S&T at regular intervals to aid the Government in S&T planning and policy making. For such reports – S&T indicators and White Paper on S&T – it is a prerequisite to have adequate back-up of data on time series basis, not only on S&T activities, but also on relevant socio-economic parameters. Keeping the importance and the need of S&T indicators for S&T planning, policy making and management in view, the DST started the exercise of planning and preparation of a data book such as the one being reviewed now.

The first in the series titled *S&T Pocket Data Book – 1989* was prepared in 1989 at the initiative and guidance of the author of this review and she authored the next three series till her retirement from the DST. The department continued this exercise and brought out the fifth and sixth series, the latest being the one under review.

There is no doubt that such data books are valuable in terms of getting S&T and other related and relevant economic and social time series data and a large number of users find the data book extremely handy. Since planners, policy makers and researchers would like to see the trend of input into S&T as also the trend in economic and social parameters, as S&T has an impact directly or indirectly on the economy and society, the content of the data book could be an important source for such analysis. Such data books should expand the coverage and content over the years, to accommodate changing needs and change in definition of S&T terminologies. But so far in all the six series, the contents remain the same, as no additional input has been effected. *Science and Technology Data Book-2000* is based on the survey data of 1996–97 and so the data contained in the book relate to 1996–97 or earlier. So the title *S&T Data Book-1997* would be more appropriate to give a true representation of the content, as otherwise readers would expect data close to the year 2000. Coming to some specific comments on the contents of the book, there is a difficulty in comprehending data at constant prices with two base years, viz. 1980–81 and 1993–94 in the same table. It is better to construct two separate tables – one based on base year 1980–81 and another based on base year 1993–94. A note is required as to why the base year is revised to 1993–94. In future series, perhaps it is better to give values in millions or in thousands instead of in crores or lakhs, to conform to international practice. Some graphs are wrongly depicted due to wrong scaling like the graph on p. 9 using wrong X-axis. Some titles of tables need editing. Some data need to be updated, like the tables in pp. 27, 29 and 57, which give latest data only up to 1989, while the data book was brought out in year 2000. Rearrangement of some tables is necessary to bring in greater meaning. Being a statistical report, the booklet should be carefully examined and edited for meaningful presentation and content. Expanding coverage should also be planned in future by providing additional information like international comparison of patents' statistics, data on information technology, etc. in tune with changing needs. Since only a few countries like India are bringing out such data books, the DST should continue this exercise as such books are valuable sources of information for all concerned users. In order to bring out these reports with minimum time lag, the DST should make efforts to expedite data collection through National Survey on S&T and secondary sources data from socio-economic sectors.

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