

Development of Research in India: Broad Framework



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Plan



- ❧ Interdisciplinary Science
- ❧ Large Scale Science and Large Scale Facilities
- ❧ Science Needs: People, Money, Infra-structure ,
Administration
- ❧ Bhabha

Organization of Research

- ❧ Traditional areas include: Physics, Chemistry, Biology, Mathematics, Engineering, Computer Science
- ❧ These disciplines have their own culture and ways of approaching problems depending on their place in the ladder of complexity
- ❧ In the history of science one indicator of progress is the how apparently different disciplines come together to solve scientific problems: e.g. crystallography revealed the structure of DNA

Inter-disciplinary Science

- ❧ Traditional areas can and are being brought together to solve fundamental problems
- ❧ e.g. the brain is studied today using the combined knowledge of ALL the traditional areas listed above including electrical engineering, plus knowledge from the area of psychology which is traditionally a subject in the social sciences which are at the top end of the complexity chain

New need driven organization of research

- ∞ is more problem specific rather than “traditional subject” specific
- ∞ e.g. one can situate a ‘Brain Research Centre’ in an institution in which various traditional departments come together in one architectural space e.g. Brain Research Centre in UCLA
- ∞ In order to bring about such activity it is vital to create platforms or even institutions committed to providing variable platforms for people from traditional areas to congregate and immerse in solving scientific problems: e.g. KITP Santa Barbara, ICTS-TIFR, IAS-Princeton etc

Organization of Large Scale Science...and Large Facilities

- ❧ Large Data Science: Many important problems involve gathering, mining and extracting information from large data sets: Climate, Astronomy, High Energy Physics, Material Science, Aerospace, Epidemiology, Genomics etc
- ❧ High Performance Computing: CFD, Chemistry, Climate, High energy physics
- ❧ Communication networks for movement of large data
- ❧ Large experimental projects like LIGO, INO and others

Some Requirements of Research

- ❧ People
- ❧ Resources...merit based critical funding based on peer review
- ❧ Modern Infrastructure
- ❧ Management, Administrative Services, Financial Administration
- ❧ These need to be structured to help scientists rather than make managers out of them or be at the receiving end of the bureaucracy

People input

- ❧ Good training and enlightened education which is curiosity rather than rote driven is crucial for large scale inputs into research
- ❧ Outreach and teacher training with involvement from Researchers, can be very helpful
- ❧ Employment of foreign scientists in Indian institutions: Visa regime and attractive terms, also for benefiting from Indians abroad

Homi Bhabha on Administration of Science



- ❧ Emphasizing that it was in “governments interest to study and devise de novo the best administrative and financial procedures for scientific institutions and for getting the maximum return on the money spent”,
- ❧ Bhabha remarked: “ To apply existing administrative and financial procedures, devised for an entirely different purpose, to scientific institutions, is largely to defeat the purpose the government has in view, by letting the tail wag the dog”

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- ❧ Q: What is your most serious problem?
- ❧ A: “an answer which may surprise most people – the right administrative set-up. Our administration is not adapted to the requirements of the technical age.”
- ❧ “We have fortunately inherited extremely competent administrative services capable of dealing with all the types of administration which had to be dealt with before Independence in **what was intended to be a static and underdeveloped country**. Consequently experience of the type of administration needed for industry and for science and technology has been lacking”

- ❧ “It is my personal view, which is shared by many eminent foreign scientists, that the general absence of the proper administrative set-up for science is a bigger obstacle to the rapid growth of science and technology than the paucity of scientists and technologists, because **a majority of the scientists and technologists we have are made less effective** through the lack of the right type of administrative support.”
- ❧ “The administration of scientific research and development is an even more subtle matter than the administration of industrial enterprises, and I am convinced that it cannot be done on the basis of borrowed knowledge. **It must necessarily be done as in the technologically advanced countries, by the scientists and technologists themselves**”



- ❧ In the letter to the Dorabji Tata Trust, proposing the founding of TIFR he found it necessary to emphasize “Financial support from Government need not, however, entail Government Control” and quoted Prof. A.V. Hill for the British practice, where, “a buffer of some kind is interposed to prevent Government support from becoming Government control”