Budget cut threatens Indian science

Science is often considered to be restricted to laboratory and research reports. In the political corridors it is considered to be the least priority area, as evidenced by the budget cuts by the government. The Prime Minister may have mentioned that the country should aim to double its research expenditure by 2017, to reach 2% of its gross domestic product. But the government proposals in India for the 2013–2014 budget indicate that it has actually cut research spending.

The mindset regarding science is that 'with all the suffering's in the world why invest in science'. However, the HRD minister recently showed his concern and informed the Rajya Sabha about the declining number of students pursuing higher studies in science and opting for research-oriented courses. Today less than 1% of the students pursuing higher studies opt for research courses. According to the University Grants Commission, for the year 2011–12, 160,872 students enrolled for research courses against the total enrolment of 20,327,478. Can steps taken by the HRD minister to rejuvenate scientific research be fulfilled by infrastructure, for example, by setting up new institutes for science education and research, creation of centres of excellence and establishment of new and attractive fellowships? The budget cuts and year-long delays in the grants and human resource programmes are inevitably triggering widespread disappointment among scientists.

Indian science overall needs a facelift. Recently, C. N. R. Rao was awarded the prestigious Bharat Ratna. It was indeed a moment of happiness for the whole scientific community in the country. People like Rao can be role models for children who want to pursue science as a career. It is an exciting area where there is nothing to restrict you and sky is the limit for innovation, invention and discovery. However, investment in science is far too low in the country. It was indeed heartrending to hear Rao, who was angry and sarcastic from growing frustration that the scientific community is being ignored as cuts to research budgets are implemented. Innovations do not happen in a day and financial cuts become a deterrent for the growth of science.

We should not forget how microscope was discovered in Germany when epidemics of plague ravaged the country frequently. The count gave a large portion of money to a strange man who ground small pieces of lenses from glass and mounted these lenses in a tube. He used these gadgets to look at very small objects. The count remained firm even though the people showed their resentment to the distribution of money at the time when plague epidemics in Germany required more attention. Indeed something good came out of this and similar work done by others at other places. 'The microscope' has contributed more than any other invention for combating plague and other contagious diseases.

The government should realize the importance of science and technological tools and not overlook science budget over other issues. It is time that the government creates bigger, unbiased funding for research. This is an election year; what should we expect?

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Building research centres of distinction for action

As the developing world expands its scientific influence, existing educational institutions may consider adopting novel approaches and mindsets to meet the evolving challenges. Interdisciplinary alliances amid inventive scholars focused on national problems must meet societal needs while encouraging development of novel technologies. Multidisciplinary route of attack may be used to get solutions to important questions. This may be sponsored by establishments that approach and encourage an environment to inspire robust crossing point among scientists from dissimilar disciplines. Dwellings where biologists join forces with statisticians and mathematicians to write algorithms to identity the role of various DNA sequences in rapidly accumulating genome databases may open up unimagined possibilities for the new explorers. The newly trained scientists in advanced mathematics and statistics should enter the existing field of genomics to mine the big databases. Physical scientists and mathematicians may solidify the thinking and scrutinize the catalogue of timid tactics used in solving important difficult problems specially related to the statistical probability of sequence similarity. Institutions of imminence that are relentlessly wide-open to dissimilar ideas and are penetrable of new thinking may profit from alliances with outside investigators and establishments.

Early career researchers who are utmost imaginative and enthusiastic should be invigorated in setting up research programmes and must have compassionate research atmosphere with sound funding. These young and fertile brains could contribute to significant discoveries. Mutual exchange of scholars and stopovers from other research institutions, academic and industrial, with fresh encounters expands horizons of curiosity and may allow a different look at a complex problem.

Creativity thrives in crowded places where there is a critical mass of scientists freely mixing with each other. Many existing research centres have been built that are sparsely staffed. Staffing the existing buildings to a very high density with support for laboratory supplies and chemicals should be emphasized. Adjacent clusters of scholars with divergent interests but blending may provide fresh solutions or a different look to difficult questions or technology. New research centres should provide infrastructure support and laboratory space to prospective self-starters. There should be prospects of partnerships between researchers and industrialists who could build companies by early-stage funding, research alliances and licensing contracts. Fresh attitudes to stimulate pioneering and interdisciplinary partnership with expansive and dissimilar exploration itinerary with interfaces between multiple individuals and universities are the future. Reciprocal interchange between divergent groups, exchanges and visits from other research institutions with different interests that encourage easy-going encounters may generate interest clusters dedicated to specific enquiry or methodical tactics.

Residence for workers and transportation have challenges. There should be accommodations to house the people working at the ventures so that they can spend their time in creative work and could visit the laboratory as they wish. The preferred design should involve a bridge connection between the scholars residence, laboratory, library, computation facility, cafeteria and gymnasium. A good cafeteria is an excellent place for tea and interaction and should create a friendly atmosphere. A high-speed internet and digital access to scientific literature is also a must. There should also be a machine shop for repairing and building instruments.

Governments have the supremacy to navigate the course of science through broad funding precedence. The young investigators should be given adequate 5 yrs start funding and seed money to start a laboratory. About 10% of National budget should be reserved for enterpreneurial projects to seed young companies to inspire the beginning scientists who could make a difference with their research in creating job opportunities.

Instead of building new facilities, the money may be well used for starting new graduate programmes where advanced scholars trained in physics, mathematics and statistics are immersed into biology to bring a new revolution. The new mindset is needed to confront the problems of future and time for shift from old strategy to new is now. The go-getters who want to chart sturdy ingenious fancies in discerning new areas and wonders of nature for the public good, should not be restricted but encouraged and cheered.

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Massive phosphorus accumulation in soils: Kerala's continuing conundrum

In general, 16 nutrients are essential for normal plant growth. Of these, plants derive three major nutrients (C, H, O) from air and water, and the remaining from the soil. Nitrogen (N), phosphorus (P) and potassium (K) though required in large amounts, are not adequately available in the soil to support plant growth and hence, are supplied through exogenous sources like fertilizers and manures.

Here we focus on P, a major nutrient required for root formation and growth, synthesis of starch, protein and fat. Also, being a constituent of nucleic acids, it is closely concerned with vital plant growth processes. Like any other nutrient, P availability to crops is largely influenced by soil pH. The ideal soil pH is close to neutral and neutral soils are considered to fall within a range from a slightly acidic pH of 6.5 to slightly alkaline pH of 7.5. It has been determined that most plant nutrients are optimally available to plants within this pH range 6.5–7.5. Also, this range is generally compatible to plant root growth.

While among the major nutrients, N and K appear to be less affected directly by soil pH, the availability of P for plant uptake, however, is directly affected by soil pH. At acidic pH values (< 6.5), phosphate ions react with aluminum (Al) and iron (Fe) to form less soluble compounds which are unavailable to plants. This is a universally proven and accepted fact. Simply put, acid soils possess high P-fixing capacity.

In Kerala, characterized by heavy rainfall and extreme humid conditions, 90% of the geographic area is covered by laterite soils, which are inherently acidic. A recent study by the Kerala State Planning Board[1] involving a comprehensive analysis of soils from all the Panchayats across all districts of the state (Figure 1) shows acidity at a whopping 91% of the samples tested, with 54% of the samples testing for strong to extremely acid reaction (pH < 5.5). Thus P availability should have been seriously hampered in these soils, making it unavailable to crops. Surprisingly, this is not the case. We now have a situation with 61% of the samples (Figure 2) registering high (25–35 kg/ha) to extremely high (100 kg/ha) available P levels[1].

High P levels in these soils are usually due to over-fertilizing (through high analysis complex or straight fertilizers) or adding too much manure. Since crops readily respond to N, growers would have historically applied enough chemical

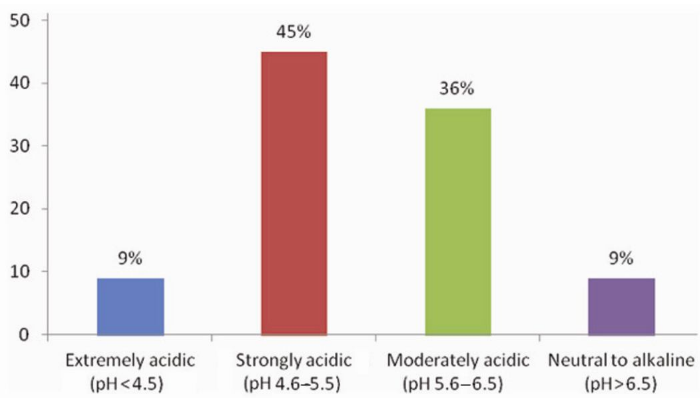

Figure 1. Frequency of soil pH classes across all districts of Kerala (n = 156,801).