

Vikram Sarabhai: science in developing countries

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Vikram Sarabhai's parents, Sarladevi and Ambalal Sarabhai wanted more for their children from education than what was available at the time in schools in Ahmedabad. In the 1920s they had travelled to London and were going to spend the next year or so in England. Young Ambalal had taken charge of the Ahmedabad Manufacturing and Calico Printing Company. He wanted to modernize the Calico Mills and learn from those in England. It was at that time that Sarladevi had learnt of the Montessori method with its child-centric approach. On their return, they established a school at their residential compound, the Retreat. 'The Retreat School was modelled on Montessorian principles, where the highest function of a teacher was considered not so much the imparting of knowledge as stimulating in the pupil its love and pursuit¹.' This was the school in which young Vikram studied and had the opportunity to not only do his academic work but to work with engineers with whom he built a small train that went around the campus. The Sarabhai family was close to Ravindranath Tagore and Mahatma Gandhi and their influences were very clearly seen in the way the Retreat School was run. Tagore's influence brought in the arts and Indian culture while Gandhiji's influence taught the dignity of labour and self-reliance. In his diary, J. S. Badami, the Physics and Chemistry teacher at the school writes that 'Vikram has a very inquisitive mind, often asks questions for explaining which I have to go far and wide out of the prescribed course. This is very good and he should be encouraged to discuss details.'² His mother, Sarladevi's remarked to the teacher, 'I am glad you are encouraging him even within the limited time at your disposal.' On his childhood Vikram Sarabhai once observed, 'All through my childhood, I was brought up on doing what one felt was right rather than what necessarily what society thought was appropriate.'

Vikram Sarabhai saw quality education and especially science education, as not only critical for the individual but for the nation as a whole. In a talk he expressed it thus: 'The development of a nation is intimately linked with the understanding and application of science and technology by its people. It has sometime been argued that the application of technology by itself can contribute

to growth. This is certainly true as an abstract proposition, but fails in practice..... History has demonstrated that the real social and economic fruits of technology go to those who apply them through understanding. Therefore, a significant number of citizens of every developing country must understand the ways of modern science and the technology that flows from it³.'

As his son, there were several instances where I (Kartikeya) experienced this thinking. In 1965, I was a student of Theoretical Physics and Mathematics studying for a Tripos in Natural Sciences at Cambridge University. When I had left India I was sure that this was what I would like to do. While at Cambridge, I was exposed to many development issues of India. In 1966 there was a major drought in Bihar and I spent my summer there, and was greatly impressed by the voluntary work which was being done and the tremendous scope for working in the developmental sector. I told Papa that I would like to work in development rather than continue to study Physics. His strong advice was that Science provides a very solid base to understand not only the phenomenon of science but other processes including development and it would really be advisable to complete my degree in science and then move to development. This was the advice I took and completed my degree before going on to do Development Communication at MIT. He advised me that many students at MIT came from engineering and science background and I would be 'more at home' with the type of approach to problem solving that was being taken at MIT. The application of education to critical thinking and problem solving was something that Vikram Sarabhai had experienced in his own education and had strongly felt that this was what was required in our educational system as well.

He said 'An ability to question basic assumptions in any situation is fostered by probing the frontiers of science, whatever field one may be engaged in countries have to provide facilities for its nationals to do front rank research within the resources available. It is equally necessary, having produced the men and women who can do research, to organize task-oriented projects for the nation's practical problems⁴.'

Today there is wide recognition that this approach of organizing task oriented projects to deal with India's problem is very much required. Sarabhai felt atomic

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energy could play an important role in Indian agriculture. A major problem with India is the ability to store vegetables and increase their life before they reach the market place. He formed a group which then came up with a proposal for irradiation of vegetables and this also led to the creation of the Nuclear Centre for Agriculture. Similarly he wanted space research in India to help with the issues of agriculture. He spoke extensively on the 'national benefits from an application of operational Remote Sensing techniques to agriculture' which he felt could be large and appealing⁵.

Sarabhai was aware that there would be tremendous pressure for developing India's space programme imitating the programmes in the West. He spoke about this pressure at a talk in 1966 where he said, 'In appreciating the value of space activities to a developing nation, one should recognize some inherent problems. They arise from the glamour that is associated with space activities. There is a real danger that developing nations may adopt a space programme largely for the glamour, devoting resources not through a recognition of the value of which we are talking about here, but from a desire to create a sham image nationally and internationally⁵.'

There were many challenges of putting a new programme together. Aravamudan writes about these early days 'Dr Vikram Sarabhai floated the idea of a space program when rocketry and space technology was unknown in India'. 'I was in a comfortable and prestigious central government scientific position in the Department of Atomic Energy⁶,' informs Aravamudan. Despite the friendly warnings from friends about leaving a prestigious job for something still in its nascent stage, Aravamudan accepted. Identifying young talent and giving them an exposure was critical to Sarabhai's way of managing any operations. He sent both Aravamudan and A. P. J. Abdul Kalam to NASA along with several others for initial training. Besides science there were many other aspects of Sarabhai's method of interacting with society and with other disciplines and societies.

In the 1960s, Thumba was a small fishing village on the outskirts of Thiruvananthapuram city. But for the country's space scientists, the location was exceptional as it was very close to the earth's magnetic equator. The site selected at Thumba lay between the railway line and the sea coast, covering a distance of about two and a half km and measuring about 600 acres. Within this area, stood a large church, whose site had to be acquired. 'INCOSPAR decided to build a sounding rocket range on the geomagnetic equator at Thumba, near Thiruvananthapuram to study of problems in aeronomy up to 200 km. The planned program would be conducted with sounding rockets and the scientific results were expected to have a direct bearing on a better understanding of meteorology.'

Kalam recalls the way this was achieved. 'Both Dr Homi Bhabha and Prof. Vikram Sarabhai were looking for a site to establish space research station in the equa-

torial region. These two great scientists visited a number of places. Thumba in Kerala was selected by the scientific community for space research as it was near the equatorial region and was ideally suited for ionospheric research in upper atmosphere apart from study of atmospheric structure. When Prof. Vikram Sarabhai visited Thumba, the locality had series of villages and thousands of fishermen folk were living in that area. It also had a beautiful ancient church, St Mary Magdalene Church, Pallithura and a Bishop's House. Prof. Vikram Sarabhai met many politicians and bureaucrats to get the place for the work of space science research. It did not move further because of the nature of the place. He was asked to see the Bishop of Trivandrum, at that time in 1962, His Excellency Rct Rev Dr Peter Bernard Pereira. It was a Saturday when Prof Vikram Sarabhai met the Bishop. The Bishop smiled and asked him to meet him the next day, i.e. Sunday. In the morning Service, the Bishop told the congregation, 'My children, I have a famous scientist with me who wants our church and the place I live for the work of space science research. Dear children, science seeks truth by reasoning. In one way, science and spiritualism seek the same divine blessings for doing good for the people. My children, can we give the God's abode for a scientific mission?' There was a chorus of 'Amen' from the congregation and the whole church reverberated. Subsequently, the big event took place in 1962. His Excellency Rct Rev Dr Peter Bernard Pereira, the Bishop of Trivandrum, took the noble decision to dedicate the church in recognition of the national goal for the establishment of the Indian Space Research Organization at Pallithura, Thumba. That was the church where we had our design centre, started rocket assembly, design of filament winding machine for FRP product and the Bishop's house was our scientists' place. Later, the Thumba Equatorial Rocket Launching Station (TERLS) led to the establishment of Vikram Sarabhai Space Centre (VSSC) and multiple space centres throughout the country⁷.'

I remember as a student in India doing a summer break attending a meeting where Sarabhai was trying to convince the audience of people from other different departments in the government why space had a role to play in telecommunications and television. He said 'In India, at the moment, we are deeply interested in an evaluation of the benefits that a synchronous satellite can provide for national needs of point to point communications, for mass communications through direct broadcast television to promote national integration as well as the economic development of isolated communities.'

'Just for one application, namely, the provision of broadband communication for reaching half a million villages of India through television, it can be shown that the investment for using satellites would be only a third of what would be required with conventional technologies⁸.'

K. G. McCracken, an Australian space scientist talks of his interactions with Sarabhai.

‘Vikram injected an element of realism into the fairy-tale world in which I was living. Thus, in 1961 he began speaking of the Indian view of Space research; a view that was clearly different from that of the developed countries which were active in space at that time. He spoke of using satellites to provide television for the half million villages of India; TV in which there would be a single video channel, and 14 different sound channels to bridge the linguistic gaps that divide the Indian nation. He spoke of agricultural, family planning and health education being given to the non-urban population by satellite. He argued that it would be faster to use a satellite to provide a high quality, nationwide telephone system than to use a conventional ground based microwave system. That is, he spoke of careful tailoring of space science to the national goals of his country. He spoke of space scientists applying their intellectual capabilities to practical problems, and set the example by doing so himself.’

As a scientist, Dr Sarabhai felt the need to prove by actual experiment that TV could actually be used as a tool for development in the rural areas. He, therefore, took the initiative in organising the Krishi-Darshan Project around Delhi, with the collaboration of AIR, the Delhi Administration and the Indian Agricultural Research Institute. This project was inaugurated in 1967 and initially two agricultural programs a week were broadcast to TV sets located in 80 villages around Delhi. Independent evaluations of this project effectively proved that TV was particularly successful in spreading new techniques and methods.

The possibilities of using high-power synchronous satellites for direct broadcast to the whole country made it possible to think of using a nation-wide TV system in India.

He did not merely suggest satellite television as a possible solution to the problems of mass-communication, education and information transfer, but he went a stage further and concluded an agreement with the United States, following the recommendations of the various studies he had initiated, to conduct a joint Satellite Instructional Television Experiment (SITE). This agreement would allow India the use of a NASA satellite for a period of one year during which the experiment would be conducted⁸.

Vikram Sarabhai established many collaborations and he was all for getting the best technologies in the world. But he was also equally clear that when we have capabilities in our own country, these need to be used first before searching for them abroad. He said, ‘There is a seduction by their (advanced nations) political and commercial salesmen who dangle new gimmicks which they suggest should be imported rather than indigenous capability be developed and supported. There are those who preach, as

guardians of the economic wellbeing of the developing nations, that we must proceed step by step following the same process by which nations themselves progressed. One is often told that such and such a thing is too sophisticated to be applied. The approach disregards what should be obvious, that when a problem is great, one requires the most effective means available to deal with it³.’

He further said, ‘One should ensure that nationals of the country at the operative level of the programme are sufficiently committed and are willing to stretch themselves to the fullest before asking for help outside³.’

P. N. Haksar, the then Deputy Chairman Planning Commission and someone who had worked closely with Sarabhai as a member of the Atomic Energy Commission recounts the way the first Earth Station came to be built in Arvi near Pune. ‘I remember once in pursuit of this deed of partnership which we solemnly executed and signed, he (Vikram Sarabhai) said to me, soon after I became a member (AEC) in an agitated mind, “What is happening to this country? Are we selling it down the drain?” I said: “Well, possibly we might be. But what is the matter?” He said: “The Ministry of Communications has signed a contract or about to sign a contract with RCA giving them a turnkey job for India’s first earth station to be built up at Arvi.” He felt that we could do it, that he could do it, that our scientists and our engineers could do it. It was a shame that this was being handed over to a foreign firm on turnkey basis. I naturally scratched my³ head. It was too big. I rang up the then secretary of the Ministry of Communications and asked him. He told me the usual story that they had made detailed enquiry, that it could not be done, that we had no competence, that we had a time-bound programme. Even if it could be done it would be late by six months, so on, and so forth. Since I could not let down my partner, Vikram, I had to think quickly as to what can one do about these things in our country? One goes to the final court of appeal. One goes to the Prime Minister. It so happened that the Prime Minister understood the message, and we had a meeting with the Ministry of Communications in their full regalia. Vikram was diffident, nervous, angry, red in his face, and trembling almost, but any rate he won, and though we had the psychological support of RCA in the electronics part of it, it was left to Indian engineers to design and build the Arvi Station⁹.’

Bruno Rossi, Professor at the Massachusetts Institute of Technology and a colleague of Sarabhai wrote about him ‘I believe that the stature of Vikram Sarabhai as a scientist depends not so much on any specific achievement as on the unique character of his scientific personality. For him scientific research was an act of love toward nature. He had an almost uncanny capability to absorb and store in his mind a vast amount of experimental and theoretical data. Having done that, and guided by what I am tempted to call an artistic intuition, he would then

proceed to arrange these data into a self-consistent picture bringing out hidden regularities and relationships; a picture which, through the years, would progressively evolve and become more precise. This is why his death dealt such a hard blow not only to the personal feelings of his fellow scientists, but to science itself¹⁰.

For Vikram Sarabhai, science education, research, institution building and working for development were a continuum. He said, 'The most effective development of education can take place only when the teacher, the student, the parents and the outside environment can interact with one another, in a series of feedback loops, free from regimentation and irrelevant theories and principles preached from the top.'

Once sitting in the United Nations Building, Vikram Sarabhai told Axel Horn, the American science educator who worked with him on developing the Community Science Centre, 'I have gone through three careers during my lifetime – scientist, industrialist and public servant. I want my final reincarnation as an educator¹¹.'

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doi: 10.18520/cs/v118/i8/1203-1206