

END NOTE

Basics Matter

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We in the developing world have to dream big for our ambitions and aspirations to be fulfilled.

When I was young, India was not free. In my state of Karnataka (the capital of which is Bangalore), there were no more than 10 high schools, and only one science college and one arts college. Education was meant for the lucky few. Today, India has a large number of schools, colleges and universities. Thousands of young people graduate from these institutions each year. From a situation where there was almost nothing, China, Brazil and India currently have a large and growing number of educational and scientific institutions. Many of these institutions, especially those devoted to science and technology, are directly contributing to development.

India once thought that major institutions, such as the Indian Institutes of Technology, would be responsible for major social changes. What has happened is that graduates from small institutions and even unknown colleges have been responsible for the rapid expansion of the information technology and biotechnology, manufacturing and other sectors of the nation's rapidly growing economy. A sustained commitment to higher education and scientific research over the past five decades has made all this possible.

When we look around the world, we see that countries that are economically and industrially advanced are also technologically advanced. We also see that technological advancement is always accompanied by scientific advancement. Therefore, if developing countries are to advance economically and industrially, they must invest in science.

Even the poorest countries require a critical mass of scientists, if not for the purposes of technological innovation, then at least to carry on a meaningful dialogue with advanced countries. Such a critical mass is also important if they are to make a quantum leap into the future by gaining from the experience of other developing countries. Above all, citizens across the world, and especially in the developing world, must know the language of science, which can be acquired only when there is sufficient support for science education and research.

Let us look at what has happened in Asia in recent years. Japan has long been technologically advanced, but it has been investing even more in science recently. South Korea has done the same. Singapore, which focused initially on product development and providing infrastructure and services for industries, is now investing in science in a big way.

Brazil, China and India have recently shown marked progress in science. Indeed China has become a giant in science and technology. India



has increased its investment in science and higher education by several hundred percent. Ideally, all the developing countries should increase their investment in science and higher education to a level of funding that is 2–3% of the gross domestic product (GDP) for higher education, and at least 1% of the GDP for science and technology.

China's contribution to scientific research is increasing at a remarkable pace. Indian scientists are currently responsible for about 2.7% of the total number of peer-reviewed articles published worldwide. The contribution of the developing countries to the world's top research publications, however, remains small. India's contribution to these elite publications is less than 1%, compared with more than 60% from the USA. In 2007, China graduated 16,000 PhDs and Brazil graduated 10,000 PhDs.

Despite gains, high-quality contributions to scientific publications from all the developing countries have yet to reach 5% of the world's contribution. The least-developed countries make virtually no contribution. We need to worry about not only the quantity but also the quality of publications produced in the developing world.

Indeed, it is important that the developing world contributes 25% to the world's scientific research literature, and 10% to the top 1% of global scientific publications.

As far as I am concerned, there is no such thing as applied science. Instead, there is science that has been applied, and science that has yet to be applied. What is important to realize is that without a strong foundation in basic science, applied research becomes difficult. If a nation wants to have technically trained scientific personnel capable of making long-term contributions to society, it must provide students with a strong foundation in fundamental science.

A good scientist can contribute to many applied problems if he or she is well versed in the fundamentals of science. Some feel that by supporting the so-called applied sciences, developing countries will be able to get ahead faster. But it is the other way round. In India, for example, many of the large scientific institutions that have focused mainly on 'applied' research have experienced a slow decline in quality and usefulness. Long-term national development plans should, therefore, include plans to produce graduates and PhDs with a thorough background in basic science.

Scientific discovery and technological innovation will continue to be major human endeavours as long as humans exist. Innovation will gain increasing importance due to the seriousness of the global and national problems we now face. For innovation to flourish, we must encourage the participation of all the world's people in the quest for scientific discovery. That is because talent, brilliance and originality are likely to be present to a greater extent in the villages and farms of the developing world where more than 60% of the global population lives. Unless the masses of people residing in often forgotten parts of the world can contribute to global knowledge, we will not be able to solve the pressing problems of humankind. These neglected populations require an infusion of knowledge and, most importantly, an infusion of basic science.

We in the developing world have to dream big for our ambitions and aspirations to be fulfilled. Only when we become equal to advanced countries, at least in knowledge, will we have a chance to build an equitable world, marked by peace and prosperity. ■

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