

## Resurgence of Innovative India

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I am using the term 'Resurgence of Innovative India' because India is always innovative, a greatly innovative nation. Since the time of the Indus Valley Civilization, innovation has been a part or rather the very basis of Indian culture. So the word 'innovation' is nothing new to the Indian context. We made innovations of the most admirable and advanced kind. We had excellent town planning, standardized burnt bricks for house-building, in-built drainage system, use of ceramics, solid-built carts. The dockyard at Lothal is regarded as the largest maritime structure ever built in the Bronze Age. Just see how great we were 5000 years ago! Again, the discovery of zero and the decimal value system dates back to the Vedic times that witnessed the pioneering works in algebra, trigonometry, and geometry. Innovations in the field of medicine and surgery were concerned not only about curing diseases, but also about the preservation of health.

The question then arises, if India reached such great heights 5000 years ago, what happened subsequently that triggered our slide? The slide actually started a few centuries ago, when the Western world was undergoing a sort of upsurge in the fields of science, medicine, art and architecture, literature, navigation and exploration, and also industrial and technological revolution. Exactly that was the period when India was going through a period of stagnation. The society was then feudalistic where superstition reigned. Colonization further added to the woe. Yet, in spite of this

period of darkness, outstanding scientific discoveries and innovative experiments were done in the 1920s by such Indians as J. C. Bose, S. N. Bose, P. C. Roy and C. V. Raman, to name but a few. Since then we have not seen any individual work of that kind or class. And this is where the city of Kolkata comes in. I think one should continuously remember these great men and this intellectual capital city of India, Kolkata, to invigorate oneself.

Now, I do believe that we have an opportunity to start the resurgence of innovative India. I always talk about India winning two freedoms. One is the political freedom of the 15th of August 1947, and second is the economic freedom which Dr Manmohan Singh gave to India by liberalizing the Indian economic policy in 1991 as the then Finance Minister. This is 2007 when we are celebrating 60 years of Indian independence. But I say, no. We should also celebrate 16 years of Indian independence, I mean economic independence, that we achieved—thanks to the epoch-making steps taken by Dr Manmohan Singh who converted an agrarian Indian economy to an industrial economy. A closed economy became an open economy. In the old economy, growth rate was around 3.5 per cent. But in 2006 it rose to 9.6 per cent. An average of more than 8 per cent growth rate we had in the last four years. And we do have the capacity to go beyond 10 per cent.

Just imagine what was happening in 1991 when we opened up. Do you know what was our foreign exchange reserve? It was just pretty

too little that could cover the cost of import of one week. It is now over 270 billion dollars. We are the fourth largest foreign exchange reserve holders in the world. From a state of bankruptcy, auctioning gold, we have now crossed the 270 billion dollars-plus stage. How this has become possible? It is because he gave us the freedom to compete.

I give an instance to elucidate how this freedom was almost non-existent. J. R. D Tata had said way back in February 1978 that if he had been allowed to manufacture a car, he would have been as good in it as he is with his trucks manufactured at Telco. When competition was allowed, Ratan Tata rolled out 'Indica'. How much did he invest? 1760 crores of rupees—the highest investment made by a private sector company. When a private sector company invests an amount as large as 1760 crores of rupees to launch and develop a product, it is something special!

I would just like to take a snapshot view of what we have been able to achieve since the 1991 economic liberalization policy. If you look at Indian science and technology, and if somebody wants me to defend it, I think that is the easiest to defend because we have done so much for so little—because our national budget for this sector is more often a budget of a certain giant company in the West. And this budget includes the areas of Space, Defence, Technology, Atomic Energy and so on. If we take the field of Space Technology, we not only launched our own satellites but also those of Germany and Korea. An incredible thing about India is that whenever we are challenged we show our mettle. Take for example the issue of supercomputers. I still remember, the then Prime Minister Rajiv Gandhi had put a question: 'What are we good at?' At that time I was a member of the Scientific Council. I answered that we are good at *this*, meaning supercomputers. Supercomputers were denied to India. And in

response to that challenge, we created 'Param' supercomputer by Dr Vijay Bhatkar.

I still remember that when I returned to India in November 1976, I earned a princely salary of Rs 2,100 per month. Connection of cooking gas was then not easily available. To get a two-wheeler we had to wait for four years and, for a telephone connection, six years. And now, I think last year, seven million cell phones were sold. These are no longer the prerogatives of the people living in high-rise buildings but also owned by farmers and vegetable vendors.

Professionally, I remember the scientific breakthrough research journals and any other science journals used to take four months to reach us by sea-mail. As a result, we were outdated even before launching a project. So what competition could we talk of? When a scientific breakthrough takes place, it appears in print after two years and even that material took another four months to reach India. That means, we already lagged behind by two and a half years. And now if there is any new development, people in any corner of the world are almost instantaneously updated. Hence the younger generations today are at an advantage.

32K was considered a big computer memory. Today we make our own Teraflop computers and, among a list of 100 fastest computers, ours is the fourth, not made by government laboratories, but by the Tata Research Centre at Poona.

#### **Attitude towards people living below the poverty line**

Apart from all this material advancement, what should be our attitude towards those people who are even below the bottom line of poverty and how to include them in the country's pace of economic growth and development? I think the slogan should be 'innovation-orientated-inclusive-growth.' If we con-

sider any sector of technology where growth abounds, the challenge is to channel these technological feats to wider sections of the society. Making difference only at the top of the social pyramid is not inclusive growth. For instance, about 600,000 IT professionals contribute about 30 per cent of our exports and their average age being 26½ years. But what do 600,000 people mean? It is only 0.06 per cent of the total Indian population. The investment that the country made in educating the urban youth is paying off. And now this investment is to be made at the lower and bottom of the pyramid also. The TCS (Tata Consultancy Services) has put its heart in the right place. They have undertaken the task of making 200 million people literate in five years. While traditional teaching methods would take more than twenty years, the TCS claims that it can do it in five years. So it is using technology in an innovative way and developing a tool called Computer-based-functional literacy that would help the illiterate learn to read in 6 to 8 weeks time. These techniques enable an illiterate person to read a newspaper after attending the training programme of 6 to 8 weeks. This has been demonstrated by Dr F. C. Kohli, in-charge of the programme, in seven states of seven different languages. Now this is the tool that needs to be launched as a national mission. If the government cannot do it, then let people take it forward. Recently, during the World Bank meet, I mentioned this technique and pointed out that there are 800 million illiterates in the world. The scheme costs 2.5 dollars per person. By putting in 200 billion dollars, you will make 800 million literates.

When we talk of Indian innovations we should bear in mind that the growth has to be inclusive. So such works are admirable when we see people like Ashok Jhunjhunwala of IIT, Chennai, working single-mindedly on wireless local loop. His idea is to take connec-

tivity to the villages. Generally the IIT persons are looked upon as belonging to the elite class who are often going abroad to earn huge money. But that is not so always. By keeping the heart in the right place we believe many more such technocrats like Jhunjhunwala could be created.

Another thing. India is quickly becoming an innovation hub not only for the Indian companies but also for other multinationals from across the globe. They are setting their R & D centres here. They are here because they are getting the highest intellectual capital per dollar.

#### Grass-roots innovators

The question is: Are innovators found only among the technocrats and people working in the formal laboratories of life? No. Innovators are all around us. The problem is that we do not take any notice of them, nor do we give them any recognition when noticed. Innovators are those people who face the challenges of life and come out triumphant. Every Indian has to be an innovator of one kind or the other in order to survive. *Innovation is not doing different things, but doing things differently.* So there is latent intellectual acumen in all of us.

If you ask, what is common between a giant company and a tiffin-delivery network of the 'dabbawalas' in Mumbai comprising 3,500 dabbawalas delivering 1.5 lakhs lunch-boxes everyday, the answer is, they both have a Σ6 rating which is given to them by the *Forbes Global*, the famous American business weekly. Σ6 is an efficiency rating of 99.9999999 which means one error in one million transactions! These 'dabbawalas' are largely uneducated, but they have created an alpha numerical system which gives them the same efficiency rating. We make difference by how each of us harness the latent intelligence present in all of us. Hence we have created a

foundation, National Innovation Foundation, about eight years ago and I was its chairman. Our job is to look for grass-roots innovators. They could be farmers, artisans, school drop-outs, house-wives—anybody. We also organize a national competition. The first year we got 10,000 entries. Last year we got 100,000. We pick up the top thirty and give them awards. Out of those top thirty, I tell you, 50 per cent were illiterates. For three consecutive years Dr A. P. J Abdul Kalam, the then President of India, had handed over the awards. In fact, he invited them to his place and served them personally! I still remember. It was so touching! We honour these people not so much for their intellect as for their innovative spirit that breathes a message: 'No, I cannot live with this problem. I have to solve it.' What I am trying to point out is that there is such innovative zeal all around and we ought to recognize it.

#### **Risk-taking**

There is another thing we need to do. And that is risk-taking, something which we are averse to. I still remember one of my friends who had come from the USA said to me: 'Mashelkar, we don't fire people who make mistakes. We fire them who don't take risks. What do you do in India?' I said, 'We boot out those who take risks'. We have to change that culture. I try to do that in a small way at different levels. When I was in National Chemical Laboratory, I created what is called the 'Kite Flying Fund.' Chance of success of an idea is one in one thousand, but still I will support it. So I kept just 1 per cent of my budget for it. Then, when I moved to CSR which is a chain of 40 laboratories and 20,000 people, I created a similar fund calling it 'New Idea Fund'. Of course, funding risky ideas is difficult. So out of 500 / 600 ideas, we supported only 50-60 ideas. All the same, we made a difference. Then at the national level,

we created what is called the 'New Millennium Indian Technology Leadership Initiative'.

Indian industries have always worked where markets were certain and technologies were certain. Why markets were certain? Because we could see those products. People were already buying them imported. Why technologies were certain? Well, what we had to do was to copy. But I said, no. We will work in those areas where both markets and technologies are uncertain. Today that programme has attracted more than 80 private sector companies and more than 200 institutions are working together. And breakthroughs are happening.

I will just give one or two instances. Look at TB (Tuberculosis). Through this programme, I just referred to, people have made an innovative breakthrough. A new drug has come out after 44 years. Normally TB gets clear by around 6 to 8 months. But this newly invented drug which is in advance stage of clinical trial does it in two months. Being first in 44 years is not an issue; that it is making a difference is that which matters. This is a breakthrough coming from India, and a breakthrough that helps the poor because they cannot take 6 to 8 tablets a day for 6 to 8 months. They give up after a couple of weeks. So this is very important for the poor.

Again, a new drug to treat Psoriasis is being developed. The American drug costs over 20,000 dollars (\$1000 per injection). But this new drug comes for \$50, \$60. This proves that if you give freedom to the young Indians to take risks, they can fly.

What we also need is a change of attitude, because innovators are unusual people. They refuse a status quo. They refuse to accept that something they want to do cannot be done. So all the time they challenge and bring in unusual spontaneity. They do not crave for

financial incentives. They are emotional. They want psychic income. The great innovators who developed world's first synthetic fibre, nylon, committed suicide. The inventor of diesel engine also committed suicide. So managing such intensely creative people requires a certain understanding of the pain of creation that such people undergo and that is very important because tight control of management will not sort of produce the kind of results that we want. A great Nobel laureate once said that whatever we are allowed to imagine in science has to be consistent with everything else that we know. The problem of creating something new, something which is consistent, which has been seen by everyone, is enormous. At the same time the difficulty with science is not often with new ideas but in escaping the old ones. A certain amount of irreverence is essential for great pursuits of science. If we promote that kind of irreverence in science by changing our personal attitudes, funding patterns, creating that extra space for risk-taking, respecting occasional mavericks, rewarding the risk-takers, then not only the fun and joy of science will increase but also Indian science will make that much-needed and awaited difference.

#### **Innovation, passion and compassion**

The last point I would like to mention is that every country, institution or organization must have three characteristics—*innovation*, *passion* and, most importantly, *compassion*. So we must create a compassionate society which is innovative. It should continuously look at the problems of the poor and should ask questions as to why the design of the pulley to draw water from the well remains unchanged for 2,000 years. Now this problem has existed all along for poor women, weak women, pregnant women and children. This was the situation until an artisan probed this problem and attached a small lever onto the pulley recently.

The lever did not get on the way while pulling on the rope, but the moment tension on the rope slackens, the lever pressed against it and arrested the downward movement. As a result, now an old woman, weak and sick woman can take rest and can also sit and chat and again resume the pulling operation. Thousands of such pulleys are now being installed all over Gujarat villages. The design will spread to all Indian villages very soon. This is something promoted by the National Innovation Foundation. What did it take? Not much by way of money, but *compassion*. A great engineer did not solve the problem, but an illiterate artisan. Thousands of such illustrations can be given here. I think that can make the difference to the quality of life of the people and create a value system where problem-solving of the poor and the disadvantaged becomes the mission. And those who contribute to it are real national heroes. And we feel proud to honour such innovators and award them.

I was the president of the Indian Science Congress. Five thousand plus scientists attended one of its functions which the Prime Minister inaugurated. There were Nobel laureates too. At that time I said that Science Congress would be knowledge-congress, and people's congress. So I said, I will invite these innovators also and give them the same dais that the Nobel laureates would have. We also had an exhibition of what they did. They also spoke. They did not know English. So they spoke in Hindi, some in Gujarati. The hall was filled with scientists and, believe me, they got the greater applause than the Nobel laureates. That is the change of value system that we basically need today.

I would like to end by making a brief remark about the future. I think the future is extraordinarily bright. The future is in the hands of the young. I believe they have three advantages which are very special, very dis-

tinctive. Among the three Ds, the first is *democracy*. Democracy makes you think freely and act freely. That makes a huge difference. That promotes innovation and creativity. The second is *diversity*. We have great diversity—cultural, linguistic, climatic, bio-diversity, and others. So what happens is that when you have such diversity you have to be innovative to deal with the diversity. India can be a laboratory for the rest of the world because of its diversity. The third D is *demography*. Fifty-five per cent of Indian people are less than 25 years old. It is a huge advantage because young people are usually positive and optimistic. It is a question of giving them an opportunity. I wish we had a

fourth D, *discipline*. However, that is a different matter. I cannot predict the future. But I can assure you that India would be economically a great superpower, technologically a vibrant nation and, most importantly, it will be a moral superpower full of values and ethics. We will have to bring the values and ethics. That is extremely important. Because you may be the technological superpower, economic superpower, but if you are also at the same time not a moral superpower, you do not last. History tells us that. Look at the erstwhile USSR. They were the first two, and not the third. Nazi Germany, they were the first two and not the third and they have collapsed. ■

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### ‘March Forward and Make India Brighter’

Many times have I been told that looking into the past only degenerates and leads to nothing, and that we should look to the future. That is true. But out of the past is built the future. Look back, therefore, as far as you can, drink deep of the eternal fountains that are behind, and after that, look forward, march forward and make India brighter, greater, much higher than she ever was. Our ancestors were great. We must first recall that. We must learn the elements of our being, the blood that courses in our veins; we must have faith in that blood and what it did in the past; and out of that faith and consciousness of past greatness, we must build an India yet greater than what she has been. There have been periods of decay and degradation. I do not attach much importance to them; we all know that. Such periods have been necessary. A mighty tree produces a beautiful ripe fruit. That fruit falls on the ground, it decays and rots, and out of that decay springs the root and the future tree, perhaps mightier than the first one. This period of decay through which we have passed was all the more necessary. Out of this decay is coming the India of the future; it is sprouting, its first leaves are already out; and a mighty, gigantic tree, the Urdhvamula, is here, already beginning to appear; and it is about that that I am going to speak to you. ■

—From *The Complete Works of Swami Vivekananda*, Vol. III, pp. 285-86.