

## Leading Science and Technology: Vision for the Future



*Excerpts from the chapter 10 of the book*

### **Leading Science and Technology: India Next?**

by

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**2018 / 312 pages / Paperback: Rs 595 (9789352805082) / SAGE India**

*[T]o make a great future of India, the whole secret lies in organization, accumulation of power, co-ordination of wills.... This is the secret, accumulation of will power, co-ordination, bringing them all, as it were, into one focus.*

--- Swami Vivekananda

Let us work toward making India a scientific superpower. We can be inventors and discoverers again. We have the experience and the potential. In the present state of technological and economic change, now is the most opportune time to embark on this national journey. We have considered a number of issues with our current research ecosystem in previous chapters. Now we look at how we can improve our situation.

I begin this chapter by discussing certain general guiding principles for forwarding the research agenda. These principles, if followed, would help create an ideal research ecosystem. We can distill these principles into particular objectives for India organized by impact area. These principles are also a guide to build policies and a yardstick—the dos and don'ts—what actually helps, what impedes research, and what actually makes no difference!

The steps to achieve our objectives are many and diverse. Some we can realize in the short term while others will require patience. Some will be evolutionary while others may seem revolutionary. And they will require the participation of multiple stakeholders. All of you could be worthy contributors of ideas—good ideas come from everywhere—this is very much the spirit of research. In fact, this is the very spirit of research!

### **Sixteen Principles for Building a Highly Effective Research Ecosystem**

#### **Will and Ownership**

We need a strong belief in the virtues of science and a tenacious will to promote scientific research as a national goal. To embark on such a mission requires a buy in from everyone—starting with the media—the opinion creators, the politicians, the bureaucrats, the institutional leaders, and educators. Each person at every level should be dedicated wholeheartedly to pursuing the research agenda. Ideally, such individuals should have been deeply involved in research at some point in their career. They need to be believers, progressive thinkers, and charismatic go-getters. We need a laser focus on research and people dedicated to the task, at all levels.

#### **Plan for the Future**

When considering national policy, economic development, and scientific research, we need to build institutions and plans with a 10–20 year focus. It does not suffice merely to be reactive to just our immediate problems nor is it productive to attempt to harness immediate opportunities only. The world is changing too fast. We are witnessing the advent of new technologies and new kinds of businesses that present us with new problems and opportunities. We need to consider the big picture: predict, plan, and revise continuously. Second, we need to save ourselves from our habit of applying only “Band-Aid” solutions that are neither robust nor sustainable.

Last, we need to take into account the time it takes to implement anything systematically, specifically when being executed by the government. We should invest in sustainable long-term measures, otherwise they end up being too little too late.

#### **Understand the Centrality of “People”**

The quality of research cannot exceed the quality of the researcher. If one wishes to reap the economic and social rewards of great research, one must attract the best minds to scientific careers. Talented, capable people simply need the right incentives and a professional environment. As caretakers and practitioners of high knowledge, they must feel respected in the society and their institutions in the same way that knowledge itself is respected. Without the right people, no amount of money, infrastructure, or policy can produce transformational results.

## **Let Merit Be the Key Principle**

As a moral principle, resources for human development should be equitably distributed. But in pursuit of this moral principle, allocation of our resources for research should be merit-based and competitive. We must allocate resources to those individuals who demonstrate that they have the best research ideas, who write the best proposals, and produce the most promising results. We must be open to many different ideas and thought processes, but nothing mediocre. We should put power behind our star performers with the money, facilities, equipment, student support, and decision-making power that they need to further their success. And we need to celebrate their success and that of their institutions so that they may inspire others to excel.

## **Promote Autonomy and Accountability**

Researchers and research institutions work best when they are independent. No one should “tell” them what to do. They should be driven only by their own mission and curiosity. They should have the power to implement their plans independently. Bureaucratic rules, regulations, and micromanaging hinders creativity and progress. At the same time, they should be held accountable for their results<sup>1</sup> and ethical practices. Resources should be allocated accordingly.

## **Create Differentiators**

To compete globally, we need to reinforce our current strengths while simultaneously building new strengths. Our current strengths include our proximity to certain problems, our ability to run certain experiments that might be more difficult elsewhere, and the availability of higher performers in certain areas and cost/skill advantages. We can build new strengths by developing new innovative institutional structures, identifying promising but neglected areas, and developing new research processes and policy. By copying others, we can play catchup. In order to lead, we need to prepare for ingenuity.

## **Create Areas of Excellence**

We cannot excel in everything. A careful consideration of our national priorities, research velocity, and particular strengths will help us identify the best areas in which to focus our initial efforts. Having identified the right areas, we need to accumulate efforts in these areas—having the best researchers, the right infrastructure, and seeking to solve the toughest problems. Disruptive research happens by accumulation and multiplication of success of several researchers in a healthy ecosystem. Mission-based programs and institutions is one good way of doing this.

## **Raise the Bar**

Top papers and citations are great, but they cannot be goals in themselves. We must raise the bar and aspire to solving our biggest puzzles and toughest problems. We cannot be mediocre in our choice of problems. We can expect to solve some problems, make progress with others, and sometimes stall. For these, we should not bring down the dream. Real breakthroughs come about by dreaming—it is a culture and a way of working with perseverance and grit. At the end, we need to benchmark ourselves on the big ideas and solutions that come out of India.

## **Respect Ideas, Respect Failures**

We need to respect ideas: not just small, safe ones, but big and crazy ones! Science cannot afford to be complacent and arrogant. Science keeps surprising itself over the ages.<sup>2</sup> We need to be open to the potential of new, strange ideas and provide resources to test them. When we support radical ideas, there will be failures. We must accept that this is so and remember that failures also impart knowledge. The few successes that we achieve will outweigh a slew of failures, and our mistakes will help us learn.

## **Create Awareness**

No one can be forced to do research. Good research never results from compulsion. The way to enable research is to create awareness about it among all—the government, our institutions, the industry, and the industry and the society, at large. Awareness of research will celebrate its virtues and provide role models. It also is about the larger virtue of scientific thinking itself. By such awareness, the intellectually curious will steer themselves toward research automatically. These self-selected individuals will become the best researchers.

## **Create Competition**

Top performers can be spurred to even better performance through competition. Competition is a key factor in motivation, pushing people and institutions to excel, take risks, and explore the out of the ordinary. There are many examples of competition inspiring people to move out of their comfort zones, try something disruptive, and thereby achieve success. We should create challenges for researchers to compete. We should distribute research resources and funds competitively. The process needs to be world class, transparent, and fast.

## **Remember, Money Is Not a Bad Word**

Money holds people accountable, provides incentives, and helps align interests. We can use money to encourage all of these things. With money as a reward, people have a higher potential for performing and a higher chance of delivering. The availability of money leads people to collaborate in pursuit of it. Money has the potential to create knowledge. It is a resource, not an end. It should be used for its very important role.

## **Create Incentives**

The enigmatic curiosity and virtue of the researcher is not enough to support research. Individuals and institutions perform better under the right incentives, which must be professional as well as monetary. A researcher cares most for an environment that helps multiply their success and makes big impact. Such things are at least as important to success as a large paycheck. As a nation and our institutions needs to make these possible—these are the greatest incentive for researchers.

## **Look for Alternatives While Working on Foundations**

There are new ways to research, raise money, and disseminate research results. Crowdsourcing, hackathons, *jugaad*, 3-D printing, and social media are some examples. We should delve into these and use them to advance knowledge in the best way. However, nothing replaces well-functioning universities, PhD programs, transparent and merit-driven funding agencies, and communication and collaboration in the form of conferences and journals. These are all essential components of the research ecosystem. New innovations will never diminish their necessity. They shouldn't be an excuse to neglect these.

## **Make the Market**

Research is a public good. Around the world, governments are the largest funders of research. The beneficiaries of this funding are private players and individuals, who convert their research into products and services that improve our lives and provide economic gains. The government's role as sponsor entails making a market for private actors to participate in all parts of the research ecosystem. Government measures could include tax breaks for conducting research and for research philanthropy, colocating research institutions and academia, IP help, and public funding of innovative companies deemed too risky by private lenders. This is useful for scaling research, but also essential for deriving tangible outcomes.

## **Be Dispassionate and Transparent**

Good science is beyond social, political, or religious considerations. Research must be approached dispassionately. The researcher must be prepared to accept the results, regardless of the degree to which they conflict with prior assumptions and hypotheses. A researcher also must have the courage to reveal the results without fear of political and social implications. Political actors should not seek to silence or censor public intellectuals, regardless of whether they are public employees. Scientific voices must be independent. Noam Chomsky, Richard Stallman, Thomas Piketty, and Thomas Nagel, all professors at top universities, have held controversial views on political, scientific, and ethical issues. They continue to enjoy the support of their universities. Donor agencies and universities should vigorously support the autonomy of researchers and the research process and never seek to bend the proposal to serve an ulterior goal.

***The second part of the chapter 10, "What India Needs to Do? will be published in the next issue.***



**A panel headed by retired SC judge BN Srikrishna submitted its report to the government on suggestions for a data protection law that will also cover Aadhaar. The panel recommended certain measures for protecting personal information, defining obligations of data processors and the rights of individuals. It also suggested various penalties for violation of data privacy.**