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EMPOWERING TIMES



THINKING ALOUD
The Journey Beyond Science:
Becoming Institution Builders
Jay

PODIUM

Dr. Raghunath Mashelkar
Scientist, President of the
Global Research Alliance



WE RECOMMEND

Just Aspire
Ajai Chowdhry

Dear Reader,

Science and technology continue to play an important role in shaping economies. Institutions dedicated to scientific research and education are given more importance than ever before as today they are the bedrock upon which a nation's scientific backbone is built upon.

Institution builders possess the ability to envision future institutions as centres of scientific innovation and knowledge by leveraging their leadership skills to bring together diverse stakeholders and resources. Their nurturing of talent is a central role, creating an environment that promotes the development of young scientists, establishing mentorship programs, and investing in educational infrastructure to ensure a well-prepared next generation.

The theme for **ET** this month is '**Building the Scientific Backbone of a Nation: The Role of Institution Builders**' dedicated to those who are devoted to ensuring the legacy and sustainability of their institutions for generations to come.

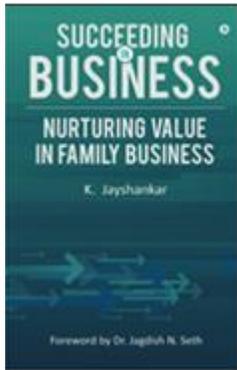
In the **Thinking Aloud** section, **Jay** highlights the role of science in shaping a nation's destiny by emphasizing the enduring contributions of visionary scientists and institution builders who have transcended from humble beginnings and are pivotal in driving scientific progress. On the **Podium**, **Dr. Raghunath Mashelkar**, Scientist, President of the Global Research Alliance and a visionary leader known for transforming scientific institutions, emphasizes private sector involvement in research through open innovation and infrastructure support. A strong advocate for intellectual property rights and the concept of Gandhian engineering, he is optimistic, highlighting the need for a culture of questioning, risk-taking, and collaboration to address global challenges effectively. In the **We Recommend** section, we review **Just Aspire** by **Ajai Chowdhry**, which is an account of the author's journey of co-founding HCL and becoming a prominent entrepreneur, offering valuable insights and inspiration for aspiring individuals on entrepreneurship, technology, and the path to success.

In **Figures of Speech**, **Vikram's** toon makes learning science fun for all!



Please also [Click Here](#) to check out our Special issue of ET, which is a collation of selected themes that were featured over the years highlighting the changing landscape of the business world. This special edition has been well received and can be [Downloaded Here](#) for easy reading and is a collector's item.

As always, we value your opinion, so do let us know how you liked this issue. To read our previous issues, do visit the Resources section on the website or simply [Click Here](#). You can also follow us on [Facebook](#), [LinkedIn](#), [X](#), [Threads](#) & [Instagram](#) - where you can join our community to continue the dialogue with us!



Out Now!

Succeeding in Business: Nurturing Value in Family Business

What makes some family businesses grow from strength to strength? How do you ensure that value is created and not destroyed when a business passes hands from one generation to the next in the Indian context? How can old families incorporate new ideas to revitalize themselves? Is there a role for professional management in Indian family business?

*This book offers answers to the vexatious issues that families face in their growth journey. The pointers provided can be used as a guide for nurturing the business and to leverage the traditional strengths that family businesses possess. As a counsellor and trusted advisor, the author, **K. Jayshankar (Jay)**, has had a ring-side view of how family businesses have functioned. The practical insights drawn from his experience of four decades has been combined with conceptual elements to become a valuable primer for a family that wishes to succeed in the competitive marketplace that is India.*

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THINKING ALOUD

The Journey Beyond Science: Becoming Institution Builders

Jay

Two recent events in India brought to fore the role of science in and its impact on shaping the destiny of a nation. One, the recent success of Chandrayaan 3 which has spurred a new interest in matters scientific with Indians marvelling at the achievements of ISRO. The second, the passing of Dr. MS Swaminathan after a life well-lived (more on this later).

Many of these achievers, who have worked for decades away from the limelight as anonymous government officials, are now being feted for their outstanding acumen. The media has offered human interest stories about these scientists and their humble origins from interior India - many being products of lesser-known government educational institutions. Clearly, their personal mettle did not depend on their origins, but they stand out for their contribution as a team that believed in their mission of bringing scientific glory to the nation.

What is significant to remember is that such institutions have been created by certain visionary leaders of yore who set the agenda decades ago. Stalwarts like Homi Bhabha, Vikram Sarabhai, Satish Dhawan are remembered as institution builders for they were visionaries who challenged conventional notions in a young country still grappling with limited resources. Science, however, is a long-term team game. Work initiated by a researcher has to be scoped further by a crew of equally committed individuals, but they need to be nurtured by a leader who believes in them, as well as their dream. Tales abound of disappointed researchers who have felt abandoned when they ran out of funding when promised grants vanished due to budget cuts. It takes an exceptionally driven individual to labour alone when others have given up on the project. If there ever was a fairy tale with a happy ending, Katalin Kariko's story would be it. An immigrant who faced difficulties all her life, she stuck to her research on mRNA (despite being demoted four times!) until the limelight of the Nobel Prize in Medicine shone on her colleague, Drew Weissman, and her, this year. And, then of course, the PR machinery brought the leaders of UPenn on the stage to share the credit! What irony!

Leadership is arguably the toughest assignment in the room, be it providing directions to a research team, or allocating budgets to competing projects. Unlimited resources are fiction. And, turning down risky new research ideas in favour of the sure-shot conventional approach is practical management, isn't it? But this is the crux of leadership. First, are you willing to shape the institution to win today and create the pipeline for tomorrow's triumph? Second, are you able to enthuse your team members to stomach the disappointments of today and still be up to the challenge of tomorrow? This calls for immense capacity to inspire with empathy. Finally, are you able to shed your technician hat and become the evangeliser to excite the powers-that-be so that a flow of resources is created to fund the future? This is perhaps the most difficult task of all. Organizationally, there is a quantum change in the role of the conductor of the orchestra and being the principal first violin (concertmaster or head of the strings section). As the CEO, the ability to navigate multiple horizons is vital, besides needing the communication skill to sell the dream of the future that will bring in investors (be it public, private or government). Doing all this while your heart is still in the lab work (as often science is the first love for most researchers) calls for mastery in managing time and artful delegation. Very few have done this with distinction.

There are some more who come to mind - but this scarce breed of scientific leaders deserves greater recognition. For they are the real heroes who bring generational shifts in society.

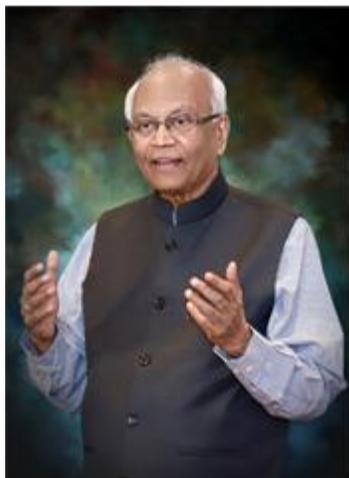
As I close, one such master comes to mind. Tributes have flowed in praise of a remarkable scientist/administrator, Dr. M S Swaminathan, who departed recently. Acknowledged as the Father of the Green Revolution, he made the fight against Hunger a life-long mission, reminding us that 'The future belongs to nations who have grains not guns'. Such rare individuals are visionary scientists who have straddled multiple fields and created lasting institutions.

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Podium

Dr. Raghunath Mashelkar

Scientist, President of the Global Research Alliance



Dr. Raghunath Mashelkar has held the positions of Director General of Council of Scientific and Industrial Research (CSIR), President of Indian National Science Academy, Chairman of National Innovation Foundation and President of Global Research Alliance. 47 universities around the world have bestowed honorary doctorates on him.

His sixty plus honours include the prestigious Lenovo Science Prize, the highest honour given by The World Academy of Science for his contributions to fundamental research as also JRD Tata Corporate Leadership Award for his transformative leadership of CSIR's 40 national laboratories, which has been also ranked among the top ten achievements of Indian science and technology in the 20th century.

He has been on the Board of Directors of several of India's leading companies, which include Reliance, Hindustan Unilever, Tata Motors, Thermax, Piramal Enterprises, KPIT Technologies, etc.

He has been elected as Fellow of Royal Society (FRS), Foreign Associate of US National Academy of Science and also US National Academy of Engineering, Associate Foreign Member, American Academy of Arts & Sciences, Fellow of Royal Academy of Engineering, UK, Foreign Fellow of Australian Technological Science and Engineering Academy, Corresponding Member of Australian Academy of Sciences, Fellow of World Academy of Arts & Science, USA and Fellow of US National Academy of Inventors.

Dr Mashelkar brought awareness of the importance of intellectual property rights in academia, research laboratories and also industry. He got the wrong US patents given on turmeric and Basmati, which finally led traditional knowledge gaining its rightful place in the knowledge systems. He proposed and promoted the

concept of Gandhian engineering, with a paradigm of 'more from less for more', effectively making high-technology work for the poor.

He was a member of Science Advisory Council to the successive Prime Ministers for over 30 years. He has received the Star of Asia Award at the hands of George Bush Sr., former President of USA. He has also received the Padma Shri, the Padma Bhushan and the Padma Vibhushan at the hands of the President of India.

ET: Building institutions often requires visionary leadership. Could you share your insights on the qualities and skills that are essential for institution builders in the field of science and research?

RM: The leadership of a scientific research institution requires a unique blend of scientific acumen, management skills, and a commitment to advancing knowledge and addressing pressing scientific challenges. Here are some qualities and skills that I feel a leader heading a scientific research institution must have.

First and foremost is being a visionary, having a grand vision. The ability to articulate a clear and inspiring vision for the institution's research goals and long-term impact on the field is essential. The leader must be able to galvanise the institution for positive action, not just by words but by action. Communication skills are a part of it. The ability to convey complex scientific ideas, secure funding, and engage with various stakeholders, including researchers, funders, and policymakers can make all the difference.

Second is one's own high personal standing. If one is a tall scientist oneself, that helps. It draws respect, admiration and acceptance from colleagues. The colleagues get the feeling that the leader has travelled the path oneself to reach great heights, so one knows what one is talking about. A deep understanding of the scientific domain and the ability to stay up-to-date with the latest developments and trends is very important.

Third is team building. The capacity to build and nurture a diverse, collaborative, and high-performing research team while fostering creativity and innovation is very important.

Fourth is risk-taking. The willingness to encourage, support innovative research ideas, and take calculated risks to push the boundaries of knowledge is important. In the same vein, there must be an astute ability to spot talent, especially when any honours or accolades have not been bestowed on him or her. Spotting the potential and laying a bet is not easy. But, having spotted the potential, helping the scientist to realise one's potential is equally important.

Fifth is the commitment to ethical conduct in research. That includes promoting integrity, transparency, and responsible research practices so that the scientists don't get swayed into some unethical practices due to the strong competitive pressures.

ET: You have held leadership positions in various scientific and innovation institutions in India. Could you share some insights into the challenges you faced and the strategies you employed to transform these institutions into world-class entities?

RM: During my leadership of the National Chemical Laboratory (NCL), it transformed itself into an International Chemical Laboratory. It did the seemingly impossible - exporting knowledge from an Indian laboratory to leading multinational companies. This was a first in the Indian history. This NCL transformation is a case study in the Emerging Economy course at Harvard Business School.

NCL had secured zero US patents in its entire history. From that to becoming a leader in US patents in a span of just a decade was a remarkable story. Here is the story.

On 1 June 1989, I became the Director of NCL, which already had a high reputation in chemical research. The challenge was to convert NCL from a very good laboratory into a front-ranking world-class laboratory. In 1989, huge tariff barriers protected the Indian industry. The industry was in the sellers' market. NCL scientists responded by essentially doing import substitution because that was what the Indian industry demanded. Context decides the content. It was clear to me that if NCL continued to operate in this context, the content of the NCL research agenda would be just copy, copy and copy. There was no way NCL could have changed the 'national context' in those pre-1991 days, which was all centred-on import substitution. I said NCL will change its 'own context' and will become the International Chemical Laboratory by shifting its role from just a seller of knowledge to the Indian industry to a seller of knowledge to the whole world, even to top multinational companies in the USA and Europe. The very statement that 'National Chemical Laboratory' will become an 'International Chemical Laboratory' created an incredible aspiration, which, to me, is always the biggest driver of change. However, here was the big challenge. Until 1989, i.e., in 39 years of its existence, NCL had not been able to secure even one single patent in the USA! How can a laboratory with such an abysmal record of US patenting even dream of being an exporter of its knowledge to the USA? It looked impossible.

I challenged the laboratory by saying that there is no limit to human imagination, no limit to human achievement, except the limits we put on ourselves. In the import substitution era, we had put limits on our thinking. I said let us unshackle ourselves. Think boldly. Think ahead. Let us lead and not follow. NCL was charged with a new 'yes,

we can' spirit! NCL learnt to read patents, write patents, and break patents as it went into this tough game. When NCL licensed its hydro dewaxing technology patents to the multinational company, Akzo, in Europe in 1990, it was a historical event, since this was the first time a reverse transfer of technology from an Indian national laboratory to an advanced nation had taken place.

This was followed by the licensing of patents on an innovative process of engineering plastic to the US multinational giant, General Electric. This success created great awareness about the value and rewards of patenting amongst the NCL scientists. Within less than five years, NCL developed a big client list, which included the top few global leaders from around the world, from General Electric to DuPont and from Cargil to Polaroid. Moreover, there was no looking back even after I left as the Director. Soon after I left, two of Procter & Gamble's products in the market were based on NCL patents that it had licensed!

Achieving all this required a big cultural change at and by NCL. We said no more 'publish or perish'. The new driver was 'patent, publish and prosper'. We said Indian ideas must generate wealth for our nation, not for other nations, as used to be the case then. We incentivised the scientists. On NCL's Foundation Day, we started giving a silver medal and a cash prize for anyone who had succeeded in acquiring a US patent. Initially, there were barely a couple of medal winners. But the number kept on swelling as the awareness grew. Finally, the number became so large that NCL stopped giving this medal! After all, the purpose for which the initiative was started, was fulfilled.

The feeling of becoming an International Chemical Laboratory was heady. NCL raised its global ambitions. It started exploiting uncharted territories. A new aspiration that NCL should also be a global knowledge-based services provider emerged. In 1990, NCL saw a global bid for a World Bank consultancy contract for reforms of some leading Chinese chemical research institutions. NCL had never done a global bid before. But we said: let our past not be a burden on our future. We participated in the bid. NCL had to compete with the formidable Arthur D Little, Chem Systems and International Development Planners. NCL beat them and won the consultancy contract. Later on, NCL learnt from the Indian embassy in Beijing that it happened to be the first-ever consultancy offered from China to India. Interestingly, it had to come from a National Laboratory that had got into the good habit of making the impossible possible!

What were the hurdles that I faced? There were some fundamental mindset issues. We dealt with them by challenging ourselves. All these years, NCL was used to getting government grants, and no loans. NCL went out and got a World Bank loan. The good thing about the World Bank loan was that it had to be returned and not by the Government, but by NCL itself! How could it be returned, if NCL did not create surpluses or profits? That meant doing research as a business. That was not easy. When I created a new Business Development Group in NCL, I

came under attack from some leading scientists. They said Mashelkar is bringing the word "business" to the organization. That is going to corrupt the minds of the scientists. But none of that happened. NCL grew its business both qualitatively and quantitatively, and so was the case with its scientific research output with some breakthroughs in science appearing in leading journals at the same time. NCL showed that high science and science-based business could indeed coexist. The rest is history.

I then led (1995-2006) the Council of Scientific and Industrial Research (CSIR) as its Director General. It had 40 national laboratories under its wing. Leading CSIR was not an easy task. Poor science-business linkages, bureaucracy, unionization (yes, believe me, among scientists had formed unions like factory workers form labour unions!), no 'Team CSIR' spirit, low budgets with low morale were preventing CSIR from reaching its truly high potential. When I assumed its leadership, from this state of affairs, CSIR was transformed into a user-focused performance-driven organization and became a model for publicly funded R&D organizations. In what follows, I will provide a personal account of the leadership challenges and the lessons learnt during these transformations.

I led (1995-2006) the Council of Scientific and Industrial Research (CSIR), a 20,000 strong family of 40 laboratories for a record of eleven and half years. CSIR is the largest publicly funded industrial research and development chain of laboratories in the world. CSIR was born in 1942. Within the first year of my taking over, I visited each of the 40 CSIR laboratories, which were spread from Kashmir to Kanyakumari. I addressed over 20,000 members of the CSIR family.

I saw a big cultural divide between the CSIR institutions and the industry. The fact that science has to make an economic and social sense had not dawned on a large number of laboratories in CSIR, whereas demand for science from the Indian industry was sadly missing. CSIR laboratories worked on the basis of scientific novelties and perceived needs, whereas the business worked on the basis of attractiveness in the market and potential for profit. The products from CSIR institutions invariably came out as packages containing knowledge and information, whereas the business was looking for only finished goods and services, which were saleable.

The main challenge was to see that the industry viewed CSIR laboratories as idea generators, providers of new concepts and windows of knowledge on the rest of the world. I tried to persuade the Indian industry to assume the role of partners, who had the technical, financial and marketing strengths to take the ideas to the marketplace. I tried to convince the industry that it should not look at CSIR labs as supermarkets, where off-the-shelf technologies were sold, but in the true spirit of partnership, the Indian industry should willingly integrate CSIR R&D resources into their business strategy. I tried to create a climate of improved communication and understanding,

faith in mutual growth and the development of healthy working relationships. But, to build this trust and confidence in the Indian industry, I had to show that CSIR itself was willing to change.

In January 1996, we prepared CSIR 2001: Vision & Strategy, a white paper, which was an announcement of CSIR's will to change. It was an explicit agenda for CSIR with a detailed road map for attaining the true potential of CSIR. We defined a new product and a new process in CSIR. The new product was researched as a business. The new process was doing research in a business-like manner. We were enthused when the corporate world appreciated the vision paper. I remember Mr. Ratan Tata, in a private conversation with me, called it a unique corporate-like document from a publicly funded organization.

There was yet another challenge. CSIR had 40 laboratories and they had always behaved like 40 separate laboratories. The sense of belonging to a family of CSIR was missing. Amazingly, that alignment began to happen with the creation of the vision document for CSIR 2001. So following CSIR 2001, came NCL 2001, CMRI 2001, CFRI 2001; all individual laboratories aligned themselves to the vision of CSIR 2001. The CSIR labs were like disoriented magnetic needles placed on paper. It was like bringing a magnet near the paper, by which all these randomly placed needles started orienting and aligning by responding to the power of the CSIR 2001 vision!

My fulfilling moment was on 11 May 1998, when we had the CSIR Directors' Conference in Bangalore. The theme of that conference was TEAM CSIR. I was deeply touched when in a charged closing ceremony, all the forty Directors spontaneously signed a Bangalore declaration saying, "India matters to us. It is our endeavour that we shall matter to India, more". This was a perfect alignment of all the leaders to a common goal.

We made conscious efforts to ensure that the power was not centred in Delhi at the headquarters, it was where the action was. We thus empowered the Directors in the laboratories allowing them freedom in decision-making.

Autonomy goes with accountability. We built performance-based budgeting systems for the laboratories. Each laboratory was asked to develop a business plan, not just a research plan. We set targets not only on the external earnings but also on the new production to be catalysed in industry, new jobs to be created, etc. The tangible impact of CSIR on industry & society had to be assessed and measured not just for CSIR's sake, but for the sake of the nation.

I kept on making a conscious effort to awaken the scientist in an entrepreneur and an entrepreneur in a scientist. If a scientist created wealth for the nation through the technologies developed by him, then we feel that he should

also get a share of this wealth. So, we created incentive schemes for these scientists, both at the individual and institutional levels.

At an individual scientist level, we said the salary does not have to be equal to the income. In fact, the income can be much higher than the salary. We gave a handsome share to the scientists from the royalties and licensing fees that were earned. At the institutional level, we allowed the laboratories to build a corpus through the net surpluses that they generated by offering their knowledge products to the industry. The laboratories were allowed full freedom to use the surpluses in the way they wanted. This meant autonomy and freedom, but only to the performers, who generated surpluses. No surplus, no freedom!

We allowed our laboratories to set up commercial arms. CSIR scientists were allowed to be on the boards of directors of both public-sector and private-sector companies. Similarly, our Research Councils of all individual laboratories drew 50% of its members from the corporate world. This brought that much-needed corporate culture and thinking to the laboratories. We could see the visible difference that was brought about when Subroto Ganguly of IPCL chaired the Research Council of NCL or Jamshed Irani of (then) TISCO, chaired the Research Council of National Metallurgical Laboratory.

As a part of the global innovation strategy, several companies the world over were scouting for new ideas and patents. Taking advantage of this strategic shift, CSIR forged global partnerships. Thus Mobil & Indian Institute of Petroleum (IIP) joined hands to jointly develop and market the Mobil/IIP technologies worldwide. Stone & Webster of USA started implementing IIP's technologies on Visbreaking. SmithKline Beecham joined hands with the Indian Institute of Chemical Technology (IICT) in some exciting projects on drugs. Boeing partnered with National Aerospace Laboratories (NAL) for some crucial fatigue research. NAL's software supplied to Civil Aviation Authority in UK started determining the landing frequency of aircraft at Heathrow airport. NCL's partnerships with giants such as General Electric, a company with an R&D budget higher than India's R&D budget, were looked at as a model for external R&D alliances.

On 4 March 1995, I delivered the Thapar Memorial Lecture. Dr. Manmohan Singh, who was then the Finance Minister of India, chaired this lecture. It was titled "India's Emergence as a Global R&D Platform: The Challenges and Opportunities". No one had believed me then. But they believe it now. Today, over 1,500 companies from abroad have set up their R&D Centres in India, from Microsoft to Google, Samsung to Siemens, and Adobe to Amazon.

While CSIR was forging global corporate-level partnerships, not for a moment it forgot its basic charter in terms of doing what was good for India. CSIR created jobs for the poor in India. Central Institute of Medicinal & Aromatic Plants (CIMAP) had a breakthrough in menthol mint, on which 70% of menthol production in India was based. More than 5 million man-days of jobs were created essentially for the poor. It also displaced China to the second position as an exporting nation.

CSIR's breakthrough on the E-MAL, which is an anti-malaria drug for cerebral malaria was another breakthrough. This meant the supply of these affordable drugs not only to the Indians but to 48 countries in the world, many of them from sub-Saharan Africa.

Central Leather Research Institute (CLRI) was the saviour of the Indian leather industry. CLRI brought back tanneries that were closed due to pollution by developing green technology. This saved several thousands of jobs for the underprivileged poor. CSIR demonstrated by action that India mattered to it, and it wanted to matter to India, more. This CSIR transformation in the nineties has been held as one of the top ten achievements of Indian science and technology in the 20th century in the book by India's celebrated scientist, Jayant Narlikar titled as 'Scientific Edge'. Business India has written a cover story on the CSIR transformation. It was the first time such a cover story on Indian science and technology appeared in any business magazine. The World Bank has used the CSIR transformation as a model for institutional transformation. In fact, I remember Jim Wolfensohn, the President of World Bank inviting me to come to Moscow and share the experience of CSIR transformation with a presentation to the Prime Minister of Russia so that Russian institutions could learn from the experience of CSIR transformation!

How do I look back on my leadership? John Adams famously said, "If your actions inspire others to dream more, learn more, do more and become more, you are a leader". I earnestly hope that when others judge my leadership, I will clear this acid test of leadership at least with passing marks, if not with flying colours.

ET: You are known to have championed inclusive innovation. You also instituted the Anjani Mashelkar Inclusive Innovation Award for this purpose. Could you please share the context for creating this Award and what it seeks to promote, with a few examples.

RM: I set up the Anjani Mashelkar Inclusive Innovation Award in 2011 in memory of my late mother. She brought me up facing all the odds that an extremely poor widowed uneducated mother moving to Mumbai with her only child - a six-year-old boy - would face. And this she did with courage and dignity.

When she passed away, we found all the money that I had given to her from time to time over the years, tucked away in her cupboard with a note that said - don't forget our roots and use this money to honour those, who do science for the poor. To honour her wishes, I instituted this award twelve years ago. We reward breakthrough solutions for excluded members of society and especially for challenging problems of India. Let me give a few examples.

- India is unfortunately known as the heart disease capital of the world. Heart attacks are difficult to detect and access to medical emergency care becomes a problem. Sanket makes it possible to monitor the heart condition anytime, anywhere. The high-tech 12-lead ECG recorder connects to a smartphone wirelessly and displays and records ECG graphs on a smartphone. The cost per scan is barely Rs 5.
- 90% of women in the developing world do not have access to any mechanism for early detection of breast cancer. Mammograms are used conventionally for diagnosis which are expensive and painful. iBreastExam is a portable, radiation-free, and non-invasive device to detect early signs of breast cancer. It uses innovative sensor and material technology combined with software computing to accurately identify cancerous lesions and tumours, providing radiation-free, painless breast exams.
- Globally, millions of women die preventable deaths every year due to pregnancy-related complications. In India, rural women are nearly 3 times more likely to die from complications during pregnancy or childbirth than those in more urban areas. SaveMom is a holistic IoT-based remote monitoring maternal healthcare solution which uses smart wearables, point of contact testing devices and a back-end software to monitor vitals of pregnant women and newborn children for over ~1,000 days at only Rs 1 per day. The solution also helps predict risk of pregnancy in the first trimester.
- India has only 1.9 million hospital beds and 95,000 ICU beds and a ratio of 2:1000 nurses as against 3:1000 recommendation by WHO. Dozee offers continuous, contact-free remote monitoring for patients under critical care. It has an alert monitoring system - which reduces the workload of healthcare staff by 50% and also provides proactive care - all at about 1/10th the cost of conventional alternatives.
- Oral cancer screening is usually conducted using a torch or mobile phone camera. It is difficult to locate the optimal site for a biopsy based on conventional oral examination, leading to multiple biopsies, increased expenditure, and false-negative reports. OralScan is an optical imaging multimodal device for the extremely affordable early detection of pre-cancerous lesions of the oral cavity. The device uses an optical system with custom-built software and algorithms for tissue analysis.

ET: As you are aware, science in India has been largely funded by the government. However, from the earliest days private enterprise has also played a part (case in point being Tatas and the creation of the Indian Institute of Science). In your opinion what is the role of private bodies that seek to further independent cutting-edge scientific research in India? What role can they play and how can they be supported by private philanthropy and corporate CSR?

RM: It is true that Tatas were pioneers in building institutions such as the Indian Institute of Science, Tata Institute of Fundamental Research, etc., which happen to be the very best even today. The private sector can do a lot by going beyond the standard ways of donations, scholarships, chairs, etc.

Here are some novel ways, in which the private sector can help scientific research and institutions, approaches that may not have been widely attempted before:

Private sector organizations can establish open innovation platforms where they collaborate with research institutions, universities, and startups to solve scientific challenges collectively. These collaborations can provide researchers access to industry expertise, data, and resources while allowing private companies to tap into cutting-edge research.

Private sector firms can invest in research infrastructure and offer it as a service to scientific institutions. This could include shared laboratories, advanced equipment, and high-performance computing resources, reducing the financial burden on research institutions and accelerating scientific discoveries.

Private companies can establish endowments dedicated to long-term scientific research. These endowments could provide consistent funding for fundamental research areas, allowing researchers to pursue projects with a longer time horizon and potentially groundbreaking outcomes.

Private investors can adopt an impact-linked investment model, where they provide funding to research institutions based on the potential societal impact of the research. Investments could be tied to achieving specific milestones or outcomes that benefit society, aligning financial returns with research impact.

These novel approaches demonstrate the private sector's potential to provide innovative solutions and support for scientific research and institutions in ways that extend beyond traditional funding models. They foster collaboration, resource sharing, and long-term commitment to scientific advancement.

ET: You have been called an 'eternal optimist' and with a professional innings of over six decades, and having groomed young talent over the years, how do you see the future of scientific endeavour in India? Do you see crucial breakthroughs emerging out of India that can solve Indian needs?

RM: I have written and spoken extensively about this. I have often said that Indian talent is second to none. Indian genes express in Silicon Valley and create world-class breakthroughs. Why can't they express in the Indus Valley and create breakthroughs? They can. Here is how.

The Nobel Laureate Richard Feynman famously said, 'The difficulty with science is often not with the new ideas, but in escaping the old ones. A certain amount of irreverence is essential for creative pursuit in science.'

The first challenge before Indian science is that of building some irreverence. Our students are too reverent. Our existing hierarchical structures kill irreverence. Promoting irreverence means building a questioning attitude.

More often than not, in our systems, paper becomes more important than people. Bureaucracy overrides meritocracy. Decision-making time cycles are longer than the product life cycles. Therefore, the second grand challenge is that of creating an 'innovation ecosystem', in which questioning attitudes and healthy irreverence can grow.

The next big challenge is to create new mechanisms which out of the box will trigger thinking in Indian science. In the early nineties, when I was the Director of the National Chemical Laboratory, we tried to promote this by creating a small "kite flying fund", where an out-of-the-box idea with even a one in one hundred chance of success would be supported. Bold thinking was applauded, and failure was not punished. The result was remarkable 'free thinking' that gave us quite a few breakthroughs.

When I moved to the CSIR as Director-General in the mid-nineties, we created a "New Idea Fund" with a similar objective. Some interesting breakthrough research papers and patents came up. Later, we created the 'New Millennium Indian Technology Leadership Initiative' as India's largest public-private partnership, where we took up some grand challenges. Indian Industry had operated in a quadrant, where the markets were established, and technology was known. NMITLI moved the Indian industry to the quadrant, where markets were non-existent, and technology was unknown. That was real risk-taking.

At a personal level, the Anjani Mashelkar Awards are given to only those, who create the next practice, not the best practice. The best practice is following the known. The next practice is creating the unknown. That requires breakthrough research.

There is huge learning from such programs and initiatives. And the biggest is that we require some fundamental changes. Here they are.

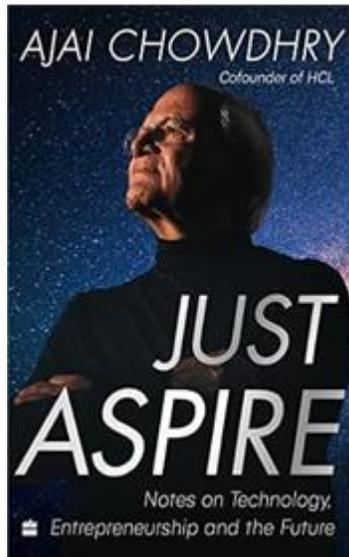
- We must emphasise that failure is an inherent part of the research process and should not be stigmatized. Researchers should be encouraged to learn from failures and iterate on their ideas.
- We must cultivate a culture within research institutions that values and rewards risk-taking. We must celebrate researchers, who embark on ambitious projects, even if they do not always yield immediate results. We must establish awards or honours for researchers who have taken risks and achieved significant breakthroughs.
- We must encourage leaders and administrators in research institutions to champion risk-taking initiatives. The current science auditing systems in India are totally risk averse. That must change.
- We must have dedicated research centres or institutes that focus on high-risk, high-reward projects. These centres can provide a safe space for experimentation and innovation.
- Encouraging collaboration across disciplines is critical. Interdisciplinary teams often bring fresh perspectives and are more willing to explore unconventional ideas.
- Finally, we will have to re-evaluate how success is measured in research. Instead of solely focusing on immediate outcomes, consider the potential long-term impact of a high-risk project.

If all this is done, Indian genes will create breakthroughs, not just in Silicon Valley, but also in our very own Indus Valley.

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We Recommend

Just Aspire Ajai Chowdhry



In *Just Aspire*, Ajai Chowdhry reveals his evolution as an entrepreneur in India's dynamic IT industry. He shares his passion for elevating the country's electronics sector, advancing its hardware, electronic goods, and electric vehicle capabilities to complement its software strengths. The book highlights India's immense capacity for electronics manufacturing and exports, as well as the need for investing in developing relevant skills and establishing policies that support this growth.

Intriguing readers from the very beginning, the author takes them on a journey back to his childhood in Jabalpur, India. With a masterful use of storytelling, the author vividly paints a mesmerizing image of his early life, seamlessly combining family anecdotes and extraordinary experiences with the vibrant backdrop of the town. From his shift from Hindi-medium to English-medium education at Christ Church Boys' School, the author delves into his diverse interests in music, sports, and reading. Digging even deeper into the author's early days and academic pursuits, the narrative brings to light the expectations his father had for him and how he made the decision to pursue a career in engineering.

The author shares his aspirations as a technology visionary. An important event in Ajai's life was co-founding HCL, where he employed inventive tactics to navigate the obstacles of a budding industry. The book delves into the development and evolution of HCL Technologies, with a focus on its transition to software and its influence on mobile communication in India. The author highlights the company's unconventional pricing and sales techniques, which set a new standard in the industry. HCL's system integration expansion is mentioned, along with efforts to promote Indian pride through their "Mindia" campaign. In addition, HCL has entered into the BPO sector and is attempting to impact India's electronics policy. The story then delves into Ajai's interactions with important players in tech, presenting his thoughts on Bill Gates and highlighting HCL Infosystems' collaboration with Microsoft. The

author reveals the challenges they faced in software pricing and piracy, coupled with their interactions with other influential figures like Steve Ballmer, Ray Kurzweil, Antonio Perez, and Tim Cook.

Ajai's commitment to building and reforming educational institutions is quite evident. It begins with the challenges faced by Jabalpur Engineering College (JEC) and underscores India's need to focus on developing institutions of excellence. Ajai shares his experiences as the chairperson of the Indian Institute of Technology Hyderabad (IITH), emphasizing the importance of innovation in education. The author paints a vivid picture of the spirit of entrepreneurship and innovation triggered by the COVID-19 pandemic in India. It narrates stories of successful innovations, highlighting the resilience and creativity of Indian entrepreneurs. The author also touches on social entrepreneurship's rise in India and its potential for creating lasting social impact.

The read delves into the significance of salesmanship, emphasizing its relevance in various aspects of life and business, the importance of understanding customers, and the evolving nature of sales in the digital age. The author reveals his diverse interests beyond work, including music, a lunar mission project, space exploration, futurism and further explores Ajai's philanthropic endeavors.

"Just Aspire" is a must-read for those looking to embark on their own journey of aspiration and achievement. This book is a compelling read for anyone seeking insights into entrepreneurship, leadership, and the relentless pursuit of one's dreams. Ajai's story serves as a beacon of inspiration, a testament to the power of vision, perseverance, and the unyielding belief in the limitless potential of individuals and nations.

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THROUGH THE LENS



Our in-house photographer, **Rupesh Balsara** spots the Cream-colored Courser, a bird found in India, mainly in arid and semi-arid regions like Rajasthan and Gujarat. Known for its terrestrial lifestyle, these birds are agile runners, foraging for insects on the ground. While not endangered, they face habitat threats from human activities encroaching on their arid habitats, making them a subject of interest for birdwatchers in India.

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