



**Convocation Address by Dr. Raghunath. A. Mashelkar, FRS, President,**  
**Global Research Alliance, 15th April 2017.**

I consider it a singular honour and a privilege to deliver the convocation address of this great institution. I have watched with admiration the great march forward of this institution with a truly global outlook, extraordinary global reach and a powerful global imprint.

I want to congratulate the graduates of the day, their teachers and their parents. You will be stepping out of the portal of this Institute today in a world that is full of opportunities. India today is not just being looked at as a third world country – it is being looked at as potentially a third most powerful country in the world. My young friends, it is going to be your responsibility to build this future of our beloved nation.

It needs to be emphasised that there is a seamless connection between education, research and innovation in my world class institution. Education disseminates known knowledge. Research creates new knowledge. Innovation converts knowledge into wealth. I am happy to see this wonderful combination working at SPJIMR.

This Institute is mandated with creating the business leaders of the future. As someone has said, I only think of the future, because that is where I am going to spend the rest of my life. So what is the future of business going to be like in the first place?

We are going to live in a digitally disrupted VUCA world, where volatility, uncertainty, complexity and ambiguity are going to be ruling the world. In fact, the world is changing so rapidly that it is not the change that we talk anymore, it is not even the rate of change that we talk, but it is the rate of rate of change that we have to talk about!

And talking about change, just see the way the business itself is changing. World's largest taxi company owns no taxis. That is Uber. World's largest accommodation provider owns no real estate. That is an Airbnb. World's most valuable retailer has no inventory. That is Alibaba. World's largest movie house has no cinemas. That is Netflix.

I am Sir Louis Matheson Distinguished professor in Monash University and I will be leaving for my annual stint of a month in two days. I am giving a talk there on **Science 2.0, Education 3.0 and Industry 4.0.**

As a business education institution, we should be interested in both Education 3.0 and Industry 4.0. Why Industry 4.0? The first industry revolution was mechanisation of production using steam. The second was mass production using electricity. The third used 'simple' digitisation. 'Complex' digitisation gave birth to the terminology Industry 4.0. Here cyber-physical systems will bring in dramatic shifts. Major upheavals in technology-led job destruction and creation are expected in Industry 4.0.

In the 250 years after industrial revolution, jobs have been regularly lost due to automation. But more jobs have continued to be created and unemployment has continued

to remain in single digits. But for the first time there is an indication that this picture is changing.

What are the new dynamics? First, some technologies automate physical tasks that human beings do. Second, some technologies can do the intellectual tasks. These include cognitive computing, automation of knowledge work, artificial intelligence, etc.

New technology also creates new jobs. Technology obsoletes itself at an increasingly accelerated pace. Therefore, we need more people, who will create new technology. Further, people are required to maintain any new emerging technology, be it internet of things or advanced robotics or automation of knowledge work. There will always be a great demand for experts to design, test, implement, and refine smart automated information systems.

The 2016 follow-up report (“Technology at Work v2.0”) by Martin school suggests that the technology impact on jobs will be far greater in the developing world than in the developed world. For instance, the report concludes that 69 percent of jobs in India and 77 percent in China are at “high risk” of automation as against 47 percent in the U.S. and 57 percent across the OECD.

Jobs that require emotional and relational work, creativity, synthesising, problem-solving, and intelligent interpretation will still continue to require human intervention, but the extent of this is reducing.

Computers are increasingly performing tasks that are typically considered “human” such as complex analyses, subtle judgments, and creative problem solving. We will be able to interact with a machine in the way that one would with a co-worker. Instant access to information and substantial enhancement in the quality and pace of decision making, and consequently, the performance, will be the benefit.

With exponential growth in computing power, there is a superlative increase in artificial intelligence. Thus, Google Translate is displacing translators, investment advice algorithms are displacing investment advisors, automated landing systems are replacing airplane piloting skills.

Advanced automation, big data analytics, robotics and artificial intelligence will be four major drivers. In fact, there is a saying that data is new oil. And artificial intelligence is new electricity. In fact, it is said that industrial revolution freed humanity from much repetitive physical drudgery. Artificial intelligence will free humanity from repetitive mental drudgery.

And look at the way machine learning is dramatically changing. Go, an ancient board game, has been always viewed as one of the greatest challenges for artificial intelligence (AI). In late March 2016, AlphaGo took on and defeated legendary Go player, Lee Sedol, who has won 18 world titles.

What is really remarkable is that AlphaGo played many unprecedented and creative moves. Apparently, according to experts, AlphaGo’s move 37 in Game 2 had a one in 10,000 chance being played by a human!

I strongly believe that there is no limit to human endurance, no limit to human achievement and no limit to human imagination, excepting the limits you put on your mind yourself. So be 'limitless' in terms of your imagination.

Having discussed industry, business and jobs in Industry 4.0, let us turn to Education 3.0. Education 1.0 was a source of knowledge. Education 2.0 was serving as a facilitator. But education 3.0 will be serving as an orchestrator, which helps the students to connect and co-create.

What was education 1.0? They were like Gurukuls of India, academies of Greece, etc. There was limited knowledge held by the Gurus and there was restricted access. There was one on one interaction.

Then came education 2.0. It had to do with broadcast and an assembly line model. There was mass enrolment. There was one to many information dissemination. Knowledge was limited in the books in library.

Now comes education 3.0 with dramatic paradigm shifts. What are these?

First - Information memorisation and brute force recall will be made irrelevant. From 'brain as storage' to 'brain as an intelligent processor' will become the norm. Collecting the dots will be less important than connecting the dots.

Second - humanity's accumulated knowledge will now be freely available on the Internet. It will be indexed and query-able.

Third - rich formatted content, flipped classrooms, and research material from the best faculty on a subject will be available for free.

Fourth - on demand tutoring, P2P learning, personalised and generative course structure and sequencing to meet the individual needs will be the order of the day.

What are the skills that will have developed so that we can so society 3.0 as well as industry 4.0?

There is a consensus that at least six skills will be needed in future - dealing with complexity, critical thinking, creativity, emotional intelligence, cognitive flexibility and finally there will have be the ability of co-working, co-creation and that too with both men and machine together.

Finally, to my mind, two keywords will always be important, whatever be the paradigm shifts in education, industry or business.

The first is courage. The second is heart.

Courage means ability to question with no fear. It also means going against status quo. It means showing a passion even when it is not a safe option.

And what about heart? It is the ability to care for the less privileged, to see the world through their eyes, and also the desire to make a difference to their lives.

So first about courage. Nobel Laureate Richard Feynman had famously said, 'The challenge is not to create new ideas, the challenge is to escape the old ideas. To escape the old ideas, we need irreverence.'

I was President of Indian National Science Academy. At INSA's platinum jubilee, I had raised this issue - How do we create this culture of irreverence where our young students will begin to challenge the established? A culture where irreverence will be tolerated and not demolished?

To my mind, here are some obvious fundamentals that have to change for making India more original and innovative.

The first is the issue of our cultural inheritance that inhibits questioning. India has the dream of becoming a 'start-up' nation. Israel is dubbed as a 'start-up' nation in terms of the highest number of new technology start-up companies. But it is so because young Israelis always challenge and question and are highly known for their irreverence.

Can all this be institutionalised? Yes, I believe, it could be.

I did some experiments. When I was Director of National Chemical Laboratory, I created a 'Kite flying fund'. The idea was to create a culture of irreverence, promoting an attitude of fearless questioning to generate new disruptive ideas. Just 1% of our budget was reserved for this. When I became the DG of CSIR, I created a similar 'new idea fund'. And then at a national level, I created a 'New Millennium Indian Technology Leadership Initiative, where public-private partnership for grand challenges, with a daring funding, some called it 'adventure capital' and not just a 'venture capital', was created. The results were remarkable, with a number of unusual breakthroughs appearing.

But what about industry? I remember Ratan Tata setting up a 'daring to try' programme to promote risky ideas. I remember Mukesh Ambani setting up a 'beyonders' program for developing innovation leaders, who will take risks, and think beyond the realm of obvious possibilities. I was involved in triggering both these initiatives.

Frankly, we need more of such initiatives. And that should include everyone. That should include even civil servants, who will be prepared to go by objectives by taking risks, and not merely by the rule book. Then only a 'courageous' India will emerge.

Then comes the issue of heart, compassion. I feel that the three attributes that our outgoing graduates must develop are 'innovation, compassion and passion'. And compassion is the crucial part. It comes to heart. And I have been fortunate to witness this.

Let me give you some examples. In my mother's name, I have created Anjani Mashelkar Inclusive Innovation Award. This is given for those innovators, who think from the heart. Use high technology to work for the poor. Go for 'next practice' rather than 'current best practice'.

Let me tell you about the last three winners. Last year it was Mihir Shah. He was pained by the fact that poor women die of breast cancer, because the tests are expensive. He created a non-invasive breast examination, which is simple, accurate, and affordable. It is painless because it is non-invasive. Does not require mammography. How much does it cost? Just one dollar per test! Why did he do that? Because his heart was in the right place.

Earlier, Rahul Rastogi was the winner. He created a portable 12 Lead ECG machine of the size of a match box. Cost per test? Not 200 rupees but just 5 rupees. Why did he do that? Again heart. Again compassion for the poor.

And the earlier winner, young Myshkin Ingawale created a non-invasive TouchHb instrument that measured the haemoglobin content in the blood in a non-invasive way, without taking out the blood. He saw women dying in rural villages by anaemia because their low levels of haemoglobin were not detected in time. Why? Because they were afraid

to give blood samples. And what is the cost per test? Just rupees ten. Why did Myshkin do that? Again compassion. Again heart.

My friends, all these three are young start-ups. Ideally they should be dreaming of becoming billionaires. But they were not. First, they are winning the hearts of millions today though, because their own hearts are in the right place.

So my friends, I repeat again. It is all about courage and heart. It is all about innovation, compassion and passion.

My young friends, finally at the end, you will ask me, besides courage and heart, what will it take us to succeed?

I will give you five golden rules, which have helped me. Here they are.

First, your aspirations are your possibilities, so keep your aspirations always high. We often complain about scarcity in India. But remember, the combination of scarcity and aspiration can create disruptive and game changing innovations.

Second, there is no substitute to hard work for becoming successful. Remember, like instant coffee, there is no instant success. I have myself worked 24x7, week after week, month after month, year after year and will do so till I take my last breath. The golden rule is the following. Work hard in silence. Let success make the noise.

Third, it is wrong to wait for the opportunities to knock on your door. If opportunity does not knock, build a door.

Fourth, when someone tells you that it can't be done, take it that it is more a reflection of his or her limitation, not yours.

Fifth, there is no limit to human endurance, no limit to human imagination, no limit to human achievement, excepting the limit you put on your mind. So go limitless.

At the end, my young friends, I wish you all the very best in your journey on this limitless ladder of excellence and achievement.