

**Oration 17:
2015 K.R. Narayanan Oration**

**Australia and India:
Combining Technology
and Entrepreneurship to
Innovate the Future**

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I am indeed honoured to deliver the 17th Dr K.R. Narayanan Oration instituted in memory of the late president of India, a great statesman and a close friend of Australia. At a time when technology is transforming the world we live in, I would like to take this opportunity of sharing my thoughts on how our two countries can collaborate to leverage technology and innovate a better future.

The Technology Revolution

Information technology, communication technology and biotechnology are rapidly and disruptively changing the way we communicate, educate, medicate and eradicate. The internet has created the true generation gap, in which those of us who grew up in a world without computers, mobile phones and wi-fi have to adapt to an unrecognisable world that requires skills that can deal with instant real-time responses — a transparent world

where there is little confidentiality — and, above all, develop the ability to leverage technology to innovate continuously to make life simpler and more efficient.

Genomics, similarly, has created a new breed of life scientists and researchers who look at disease in a very different way than their older peers. It is no longer about treating symptoms but about understanding disease at a cellular and genetic level to deliver personalised diagnostics and therapies. It was the unravelling of the human genome in 2000 that made this possible. Technological advancement has brought down the cost of sequencing an entire human genome from \$100 million to less than \$1,000 within a decade, thus enabling personalised medicine to leapfrog. Multiplexing genomics with molecular diagnostics, imaging and data analytics is now being leveraged at a cellular level wherein cancer cells are being deciphered and translated into tailor-made treatment regimens. Today's medical paradigm is rapidly evolving from a 'one size fits all' to a customised solution of 'the right treatment for the right patient at the right time', with the aim of minimising side effects and maximising positive outcomes. The increasing importance of personalised medicine is evident from the US\$215 million Precision Medicine Initiative recently announced by US President Obama.

Health care tomorrow will have no resemblance to what exists today. Imagine a world where every one of us will have a lifelong genome map that will be tracked for mutations that are linked to their disease causing potential. This can enable early diagnosis and early therapeutic intervention, thereby arresting disease progression and enhancing quality of life. Or, for that matter, imagine 3D printing technology that can print bespoke organs or blood vessels or bones and joints. In fact, according to consulting firm Visiongain, the forecast for the 3D printing medical market is estimated to be around \$4 billion by 2018.

It is well accepted that advancements in medical science have increased life expectancy in the developed world to over 80 years. There are 60,000 centenarians in the US today and it is estimated that there will be 1 million by 2050! Tomorrow's world will have an ageing population but with a better quality of life where the retirement age will perhaps be 80!

Technology, Innovation and Entrepreneurship

Technology, therefore, can be both daunting and tremendously exciting. To me, perhaps the most transformative power of technology is that of entrepreneurship. Technology is unleashing innovation through entrepreneurial zeal like never before. No longer is value creation linked to scale but to the power of the idea.

In 2014, the global biotech sector raised \$40 billion through venture funds, private equity and initial public offerings (IPOs) — the highest ever to date. Add information and communication technology (ICT) and this number zooms to \$200 billion. These ‘technopreneurs’ are all focused on breakthrough ideas and money is chasing every one of them.

Not everyone will succeed, but we are already seeing the crazy valuations being ascribed to young entrepreneurs who are wet behind the ears in terms of business experience but smart as they come in terms of innovative business models. For example, Google, Facebook, Twitter, WhatsApp, Amazon and Uber to name but a few. This has created a ‘start-up’ revolution the world over, from Boston to Bangalore, from Sydney to Singapore and from Melbourne to Mumbai!

We are today witnessing the birth of the ‘ideas economy’, in which the value of a company is measured by its ‘innovation quotient’ rather than traditional metrics such as revenue, profit, physical assets, etc. The potential of the WhatsApp messaging platform to change the way the world communicates led Facebook to pay an ‘innovation premium’, resulting in a blockbuster deal value of US\$19 billion. The power of the idea is being reinforced by the dizzying valuations being commanded by companies like Snapchat (US\$20 billion), Uber (US\$40 billion) and Xiaomi Corp (US\$45 billion)!

The fact that this ‘innovation premium’ is getting larger over the years is illustrated by a Bloomberg analysis that traces this through the Amazon and Netflix public offerings in 1998 and 2002 at values of just US\$450 million and \$750 million, respectively, followed by the Google IPO in 2004 at a value of US\$23 billion, which in turn quadrupled to the \$100 billion IPO that Facebook had in 2012. While all these companies have similar risk–return profiles, the investor appetite for ‘new ideas’ has emerged only recently.

Let me now focus on medical and life sciences where a technology revolution is already apparent. Cancer is no longer a death sentence but a chronic disease; rare diseases have life-enhancing therapies that can save fragile lives; and miracle therapies can make the blind see, the deaf hear and the paralysed walk. One such medical innovation is an Australian hearing implant, cochlear, to deal with deafness. Another is an Indian innovation for rapid tuberculosis detection. My own company is developing the world's first oral insulin as a tablet.

There is no dearth of innovative ideas in life sciences but, unlike the ICT sector, there does seem to be a dearth of investor appetite to digest the long time lines and complex regulatory pathways that are involved in taking these exciting biomedical ideas to the market. The US is perhaps the only ecosystem that has drawn inspiration from the marvels of biomedical science and created an investment environment that ascribes high value to innovative ideas. This has generated a virtuous and value accretive investment cycle of venture funding, mergers and acquisitions, and public offerings. The US biotech sector, therefore, rightfully dwarfs the rest of the world both in breakthrough products and market capitalisation.

I do believe that Australia and India need to emulate the US model of value creation through backing innovative start-ups if we wish to create an 'ideas economy' that generates perpetual value accretion and thereby economic and employment growth.

Genomics and big data analytics are emerging areas where Indian IT skills provide an advantaged impetus. Combine this with advanced scientific and medical knowledge in Australia and we have a win-win.

Life sciences in general provide this powerful synergy between our two countries, be it within academia or in business. Both nations have a strong tradition of science, medicine and engineering that has enabled Indians and Australians to flourish in academic and industrial research activities the world over. Australia's medical intellect has been widely acclaimed with many Nobel prizes awarded since 1945 when Sir Howard Florey was awarded the Nobel for his work on penicillin. It is noteworthy that 50 per cent of Nobel Prize winners from Australia are from the medical field. This illustrious list includes Frank Burnet, John Eccles, Bernard Katz, Peter Doherty, Robin Warren, Barry Marshall and Elizabeth Blackburn.

India's scientific intellect likewise has been showcased by several Nobel Laureates: Sir C.V. Raman, Professor Har Gobind Khorana, Professor S. Chandrasekhar and Professor Venkatraman Ramakrishnan. However, unless our respective governments recognise the potential of this scientific synergy, it will remain rhetoric. We need foreign policies to reflect on the power of collaborative innovation, especially in a world that is truly boundaryless, interconnected and virtual, thanks to technology.

The Global Employment Challenge

Today, every economy is challenged with employment. India needs to create 10 million jobs per year for the next 10 years to sustain acceptable GDP growth. European countries like Spain, Greece and Italy need to create employment for half its youth who are currently jobless, and even a country like Australia has to deal with 6 per cent unemployment. I do believe that the job market of the future will not be able to rely on the traditional pillars of lifetime employment in large companies and the public sector.

We are likely to see a much more fluid pattern of employment with people moving in and out of a vast number of fast-moving companies that are small, nimble and entrepreneurial. These companies will constantly evolve and reinvent themselves to adapt with the changing pace and face of new technologies. It is instructive to note that 86 per cent of Fortune 500 companies have either disappeared or dropped off the list over the last 50 years and the rate of displacement continues to accelerate as mega corporations like General Motors, Pfizer and Microsoft try to stave off the challenge from the likes of Tesla Motors, Gilead Sciences, Google and others. Creative disruption is radicalising the marketplace where leadership is transient and innovation is king.

An Accidental Entrepreneur

I remember when I embarked on my own employment journey. It started right here in Australia when I graduated as a young brewer from the Ballarat Brewing School in 1975. My aspiration was to pursue a professional career in brewing anywhere in the world. However, I was unprepared for the hostility and gender bias that I faced from the brewing industry,

which saw me turn to entrepreneurship quite by accident and become a job creator rather than a job seeker! I therefore call myself an accidental entrepreneur, as I never thought I was capable of starting my own business. This was an inflection point that I can proudly reflect upon and realise that, instead of the one job that I was seeking, I have created 7,000 jobs today, and, if I add the ancillary businesses that I rely on or support, it has had a multiplier effect. This is the power of entrepreneurship that must be unleashed the world over. India and Australia should create a borderless, virtual ecosystem that fosters a start-up culture that can create thousands of technology-led enterprises that can generate millions of jobs.

The Advent of Microcomputers and Genetic Modification

The 1970s was undoubtedly the advent of the technology era. In 1973, biologists Herb Boyer and Stanley Cohen showed the world that it was possible to take a human gene and insert it into a bacterium to mass-produce the protein expressed by the gene. Three years later, Boyer teamed up with a venture capitalist, Bob Swanson, to form the world's first biotech company, Genentech, with the goal of genetically modifying bacteria to produce human insulin. Coincidentally, I chose to adopt the same technology in 2000 to produce recombinant human insulin, not in a bacterium, but in a yeast.

Another breakthrough development in medical technology in the 1970s was the discovery of magnetic resonance imaging (MRI) by Raymond Damadian. This technology allowed doctors to look inside the body without the need for surgery, harmful dyes or X-rays.

The 1970s was also the decade that saw the birth of the 'internet' when Vince Cerf, Yogen Dalal and Carl Sunshine published their historic paper 'Specification of Internet Transmission Control Program'. Another major development in the area of ICT was when Martin Cooper, an engineer at Motorola, invented and demonstrated the first cellular phone in 1973.

The seeds of the electronically connected world that we experience today were also sown in the 1970s. It was the decade that saw the beginning of the journey where microprocessors would make computing faster and more mainstream. The Intel 8080 microprocessor introduced in 1974 sparked off a chain of events that led to the ubiquity of personal

computing and inspired Bill Gates and Paul Allen to start Microsoft in 1975, and Steve Jobs and Steve Wozniak to co-found Apple Computers in 1976. The rest as they say is history!

Biotechnology and information technology were in their nascency in the 1970s and the communication technology that we take for granted today was probably still in the realm of science fiction then. In fact, electric typewriters, calculators and the Sony Walkman were probably considered the ‘technological marvels’ of that time! It is interesting to note that none of them are used today!

The India of the 1970s was primitive and under-resourced. Only the privileged and affluent had landline telephones and television sets with a single black-and-white channel for viewing! Computers and mobile phones were objects of James Bond movies. When I arrived at Tullamarine Airport in 1974, Australia seemed light-years ahead of my home country with telephones everywhere and multi-channel, colour TVs and 24/7 electricity. When I started my biotech company, Biocon, in 1978, I did not have a telephone line or computer; nor, for that matter, did I have reliable electricity.

Fast forward to 2015 and you will see that there is very little to differentiate the youth in India or Australia. The youth of today’s globalised world live fast-paced lives, multitask and seek out new avenues for themselves, all of which are enabled by the technology of the day. Smartphones enable them to be omnipresent while the internet provides them access to real-time knowledge, something that was simply not possible in the 1970s.

Technology has played a truly transformative role in India’s development. A country that had no phones in the 1970s leapfrogged to mobile phones with over 800 million subscribers today, making it the largest market for mobile phones. Digital technology has also enabled India to develop a mega population database with unique identification numbers that will cover over a billion people. This has been leveraged for creating bank accounts for the masses, enabling direct cash transfers for subsidies and welfare schemes. Another electronic marvel is our voting system, which enabled over 500 million people to cast their votes electronically in the recently conducted general elections. India has embraced technology to address a number of challenges in health, education, agriculture and governance. Today, India is developing a universal health care system based

on electronic medical records and e-health centres that rely on modern computer aided diagnostics. Massive open online courses (MOOCs) and computers are enabling e-schools, technical training and higher education.

Agriculture is also a beneficiary of new technology. The early benefits of biotechnology are already being reaped by Indian farmers who are seeing enhanced productivity through the use of genetically modified cotton. Approved in 2002, Bt cotton is the country's only GM crop and covers 95 per cent of India's cotton cultivation of 11.6 million hectares. Apart from this, agricultural biotechnology is leveraging molecular markers in crop breeding for the selective propagation of genes that improve yields and resist disease.

Agri-biotechnology is providing powerful solutions to irrigation and arable land challenges in a country that has only 2.3 per cent of the world's land area but must ensure food security for 17.5 per cent of the world's population.

Biotechnology is also providing ecofriendly solutions and energy options through enzyme technologies and biofuels that will make India an environmentally responsible nation. India's daunting challenges throws up unlimited opportunities to innovate and create business solutions. Therein lies the entrepreneurial potential.

Building a Knowledge Society Together

The building blocks for close cooperation between India and Australia to create a knowledge society are already there. Australia is a destination of choice for Indian students seeking an overseas education and the number of Indian students continues to grow. In 2014, over 36,000 Indian students were enrolled into Australian universities, which is a tad higher than the UK. Moreover, India and Australia have a history of robust, productive and sustained bilateral research collaborations. For example, the Australian Centre for International Agricultural Research collaborates with the Indian Council for Agricultural Research on a range of problems of mutual interest, such as food security and the management of natural resources.

The two countries have also set up the Australia–India Strategic Research Fund (AISRF), which provides a platform for collaborative, cutting-edge research between scientists in India and Australia across a range of agreed priority areas. This platform has helped build linkages between premier research institutions in both countries. It is Australia’s largest fund dedicated to bilateral research with any country, and is one of India’s largest sources of support for international research. The Australian Government has committed an additional \$20 million to AISRF over four years from the current financial year 2015–16.

Last year, India’s National Skill Development Corporation and Australia’s Department of Industry, signed a memorandum of understanding to strengthen their bilateral relationship in the area of technical vocational education and training. The aim is to develop transnational standards to strengthen skills mobility and facilitate greater access to skilled labour across the region.

Closer cooperation and collaboration between India and Australia can create a knowledge society that unleashes the huge potential of the entrepreneurial energy in both countries, leading to start-ups that think locally but have the potential to make enormous global impact.

Start-ups: Creating Jobs of the Future

Policymakers all over the world are increasingly recognising the job creation potential of start-ups. Germany is looking at a start-up initiative to create more than 100,000 new jobs by 2020. The UK has an Entrepreneurial Action Plan that, over a three-year period, has seen tech start-ups increase from 200 in 2010 to 1,200 in 2013. Israel is running a ‘Start-up City Tel Aviv’ program to create an early stage innovative ecosystem that can extend to Europe and beyond. India recently announced a US\$1.7 billion (Rs: 10,000 crore) fund for start-ups, a US\$1.2 billion (Rs: 7,000 crores) budget to fund smart cities, and a US\$90 million (Rs: 500 crore) fund for a National Rural Internet and Technology Mission.

India’s ICT industry body Nasscom estimates that between 2010 and 2014, US\$3 billion has been invested in start-ups. India is now the fourth largest global start-up hub with over 3,000 tech/digital start-ups.

Nasscom further forecasts that, by 2020, an additional 11,500 start-ups will mushroom in India, generating at least 250,000 employment opportunities.

Bangalore is today the start-up capital of India and accounts for nearly 30 per cent of the country's start-ups. Sydney is home to half of Australian start-ups. What these two cities share is a conducive entrepreneurial ecosystem that links research, capital and technology-led ideas to the marketplace. The opportunity lies in bringing these two ecosystems together through policies and mechanisms that unleash the combined strengths of all such ecosystems in both countries.

The IT industry in India, built largely by first-generation entrepreneurs based out of Bangalore, generates annual revenues of over \$100 billion and employs some 3.2 million people. It is estimated that there will be 2 million IT workers in Bangalore alone by 2020, outnumbering those in California's Silicon Valley.

Bangalore has also attracted a diverse number of life science start-ups over the years and has grown to be the biotech capital of India. I established my own company Biocon in a small garage in 1978 as the country's first biotech start-up and built it up into Asia's largest biotech enterprise today. I owe my success to Bangalore's scientific ecosystem and India's cost competitiveness, which has been leveraged by others to create a wide and diverse biotech cluster of bio-pharmaceutical, agri-biotech, industrial biotech, bio-energy and bio-informatics companies.

As a first-generation entrepreneur who started my own business in response to my unsuccessful job pursuit, I urge every jobless person to opt for self-employment. If I could build a billion-dollar business on a foundation of innovative ideas and meagre resources, with no business experience but an abundant spirit and youthful confidence, anyone can do so. I have learnt along the way that innovation creates value and differentiation builds competitive advantage. I have also realised that businesses need to evolve dynamically as a way to adapt and leverage new technologies. I started out as a biotech entrepreneur with a mission to 'green the world' through innovative enzyme technologies for a diverse range of industries. Perhaps this was an idea ahead of its time. The '70s and '80s were not about challenges of climate change but of poverty alleviation through industrialisation. Over time, my mission evolved to 'heal the world', driven by a business philosophy to provide globally

affordable access to life-saving biotech drugs through economies of scale. I often say, a blockbuster drug is not about realising a billion dollars of sales but about treating a billion patients.

Conclusion

Prime Minister Narendra Modi recently paid a historic visit to Australia breaking a 28-year jinx and reinforcing the importance of building strong bilateral ties between our two countries. Prime Minister Tony Abbott echoed these sentiments and welcomed the ongoing and emerging business partnerships especially in mining and IT. While the focus was on mega projects, the potential to create partnerships in the small and medium-sized enterprise sector through technopreneurs, and the scope of jointly taking innovative ideas to global markets, is compelling. As Mike Cannon Brookes, co-founder of one of Australia's most successful start-ups, Atlassian, said: 'Australia does not offer the scale to support a credible start-up sector that can compete with those in the US, China and India'. In 2014, Indian start-ups attracted \$1.8 billion and China \$3.5 billion, whereas Australian start-ups received a mere \$111 million. This is no indication of the quality of innovation, but rather the ability to scale up. There exists, therefore, a natural fit for partnerships with India that offer both size and scale in markets, manufacturing and services.

As an entrepreneur, I am cognisant of the need to partner and collaborate in order to leverage new technologies that will propel our business growth. Today, we are focused on personalising our products for global markets by adapting to new technological breakthroughs in gene-based diagnostics and smart medical devices that connect us with patients through novel service and delivery models. However, this is not through being vertically integrated, but by partnering with multiple providers of smart and innovative technologies. These companies are precursors of what the future holds — a vast and vibrant marketplace of millions of small, medium and large enterprises symbiotically interconnected to deliver superior and sustainable solutions.

I would like to conclude by saying that the future will belong to those countries and companies that can unleash the power of cross-border collaborations, invest in innovation and embrace entrepreneurship as an economic model of growth.

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