Professor Subra Suresh, President of Nanyang Technological University, analyses the opportunities and challenges posed by the Fourth Industrial Revolution and tells John O’Leary that there are reasons for optimism.

The Fourth Industrial Revolution (4IR) may provide one of the key turning points that redefines the university, according to Professor Subra Suresh, the President of Nanyang Technological University, Singapore (NTU Singapore). The march of technology will create new demands that require different forms of learning and a broadening of research.

Previous stimuli for change have included the creation of the land-grant universities after the American Civil War, which were designated to receive state land and funding, and the establishment of the National Science Foundation (NSF), the National Institutes of Health (NIH), and the National Aeronautics and Space Administration (NASA) after the Second World War. The land-grant universities became the model for universities all around the world, while the NSF ushered in a new era of fundamental research that fostered discovery, innovation and scientific progress for the benefit of society.

Professor Suresh is not suggesting that current technological changes relate to a war, but he does believe that they will have similar far-reaching consequences. “Academic barriers are
already breaking down,” he says, as the implications of advances in artificial intelligence (AI) become clearer. Interdisciplinary courses and research, coupled with the use of new technologies, will change universities as surely as technology has already changed many industries.

President of NTU since the beginning of 2018, Professor Suresh outlined his vision of the future for the university and for higher education more broadly at the QS-APPLE November 2018 conference in Seoul, South Korea. His pedigree, as former President of Carnegie Mellon University, in Pittsburgh, and before that, Director of the NSF, lends him an air of authority that left delegates hanging on his every word.

In an exclusive interview for QS Showcase, he said he did not hesitate to move to NTU. “I have had a long relationship with Singapore that goes back to the mid-1980s, and have had the privilege of leading a number of initiatives that led to MIT’s major presence in Singapore”, he said. “I was a visiting professor at the National University of Singapore and have been a consultant to different agencies. It was only natural to take the job.” Professor Suresh told delegates: “I’m very fortunate to be President of a university that by most metrics comes close to the top. Despite the name, our activities at NTU are not just about technology; the College of Humanities, Arts, and Social Sciences is the second largest after that of Engineering. My own personal view is that we can’t maximise the benefits of technology and minimise the negatives if we don’t integrate human behaviour with technologies, through the behavioural sciences, for example.

“There are many positive aspects of technology, which can transform the way we teach. For instance, our Medical School (a partnership with Imperial College, London) has a unique curriculum and is able to undertake certain things that Imperial can’t so easily do, with its long history and well-established culture. Students have already seen the material and, in the flipped classroom, spend time discussing it with academics and researchers. Doing science and learning this way has the potential to produce a new and ‘different’ kind of doctor.”

One of the challenges that concerns Professor Suresh is rapid urbanisation, particularly in Asia, where, in a few decades, an estimated 70 per cent of the population will be living in big cities. At the same time, however, shifting demographics will lead to an aging population and declining birth rates with fewer young people who will attend university in countries like Singapore. Although young women excel in high school and junior college, and form a majority of university graduates in several advanced countries, their participation is still well below 50 per cent of the workforce in many areas of science and engineering, he observes.
“A young person graduating from a university today is expected to have a higher life expectancy and a longer working life,” says Professor Suresh. “Are four years enough to prepare for a lifetime of changes? What should the curriculum be?” Another trend that Professor Suresh does not see being reversed, and which will affect the way that universities teach, is ‘hyperglobalisation’, connecting young people internationally, and cementing the desire of many to study in other countries.

Professor Suresh sees 4IR as a unique and unprecedented convergence of the physical, digital and biological worlds. The internet of things, Blockchain and autonomous vehicles are early examples of what it will produce. Like other institutions, universities will have to adapt to the 12 disruptive technologies identified by the consulting firm McKinsey & Company. They include the mobile internet, cloud technology, next-generation genomics, advanced robotics and 3D printing.

However, the key question for Professor Suresh is the extent to which human characteristics will come into play at the point of singularity, the hypothetical moment when AI and other technologies have become so advanced that machine intelligence almost begins to match human intelligence, at least in terms of making decisions with very large sets of data. “In the AI age, we want to ensure that we do not lose human characteristics,” he says. “When do we exercise control over machine decisions and when will we cede them to machines?”

He gives an example of what is at stake: “Take Chinese communities in China, Hong Kong, Europe and North America. They may have similar origins but their life paths and experiences are different. Consequently, their personal sense of typically human characteristics could be somewhat different because of different life experiences. Will machines understand such individual and personal nuances when they aggregate large volumes of data across national and cultural boundaries? How do we ensure that machines don’t create the same kind of biases that humans are trying to avoid?”

Universities will have another important role, he believes. “Technology forces us to be prompt,” Professor Suresh says. “We expect an immediate response. What is the role of universities in preserving time for reflection?” he asks. “There are so many ways to look at universities,” he adds. “Some things cannot be rushed in academia, but in areas like science and technology things also have to move quickly because of the ever-increasing pace of technological advance.”
Beyond higher education, there will be a balance between job creation and destruction in 4IR. “Previous industrial revolutions destroyed millions of jobs, but eventually, many more were created, albeit several decades later in some cases. Today, there would be a revolution all over the world if we had to wait 10 years for more jobs to be created. So the question is, while many more new jobs are likely to be created than are destroyed, what will the time lag be?” he asks. The changes will bring intended benefits, but also unintended consequences. Professor Suresh quotes a report on the 20 greatest engineering inventions of the 20th century, which was followed by another report on the 14 grand challenges for the 21st century, some the direct consequences of previous inventions.
Professor Suresh regards NTU’s contribution as “walking the talk”; NTU’s Smart Campus is designed to be sustainable, eco-friendly and a living ‘testbed’ for innovation. The spectacular building, The Hive, which dominates the campus has been the NTU trademark for several years, but Professor Suresh has taken the initiative much further. Asia’s largest wooden building is due to open in 2021, supporting NTU’s aim to become the greenest university in the world.

“We want humanity 4.0 – and, conveniently, I am the fourth president of NTU,” Professor Suresh told delegates. “We have AI institutes and environmental sustainability – 95 per cent of our buildings are Green Mark Platinum certified. We are already one of the world’s most eco-friendly campuses. By 2025, we plan to cut net energy and water use, and waste on campus, by 50 per cent compared with 2011, and by 35 per cent by 2021.” He continues: “We established the NTU Institute of Science and Technology for Humanity in 2018, connecting the human condition with technology in the right way. Its themes are responsible innovation, the new urban Asia, and governance and leadership. In addition, all our undergraduates are required to take modules in digital literacy.”
Professor Suresh is sure there will be new subjects such as big data aggregation. “Machine learning is a thousand times faster than what we have been used to,” he says. “Blockchain, for example, marries computer science with other disciplines. There is a focus on AI, with ethics and governance. Another is the combination of digital technologies and art, and we just launched a Global Digital Art Prize,” he points out.

“Because of its short history, NTU has started from further behind some of the leading universities and has had to be faster. There are new industrial collaborations, for example with Alibaba, which is setting up its first research institute outside China; with Rolls Royce, which has its largest laboratory with us; and with HP, which has its largest university presence anywhere in the world at NTU.” The impressive rise of NTU in the QS World University Rankings® and its ability to recruit leaders of the calibre of Professor Suresh suggests that it will be in prime position to take advantage of, and to shape, some of the changes that he foresees.

An eminent American scientist and engineer, Professor Subra Suresh has been president of Nanyang Technological University (NTU), Singapore since January 2018. He is also its inaugural Distinguished University Professor. He joined NTU from Carnegie Mellon University, in Pittsburgh, where he was president from 2013-17. He was the only university president to be elected to all three US national academies: of Sciences, Engineering and Medicine. Professor Suresh was nominated by former President Barack Obama as Director of the National Science Foundation (NSF) in 2010 and endorsed unanimously by the US Senate. Before his appointment to NSF, he was the Vannevar Bush Professor of Engineering at the Massachusetts Institute of Technology (MIT), where he was the dean of the School of Engineering from 2007–2010. Born in Mumbai (then Bombay), he was the first Asian-born professor to lead any of the five schools at MIT and the first Asian-born scientist to lead the NSF. He has published extensive research in Materials Science, Engineering, Mechanics and Biomedicine.