
Technology for Humanity: The Humanities and Social Sciences in the Age of the Fourth Industrial Revolution

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Advances in technology in the 21st century are profoundly reshaping the human landscape. Whether we prefer to describe this development as Industry 4.0, the 4th Industrial Revolution, or by other names, there is little doubt that the world is entering into a new era shaped by technology.

Although technology has been a part of human civilization from the beginning, its influence today is pervasive, affecting every aspect of human existence. The speed of technological change today, furthermore, is unprecedented, which amplifies the disruptive influence that technology always brings. We need not debate whether the moment of “singularity” will arrive in the near future. We only need to recognize that the convergence of the physical, digital, and biological worlds will bring about significant change, and that the impact of technology on society, and on the human condition at large, demands critical attention.

On the one hand, the 4th Industrial Revolution will generate ample opportunities for innovation that would benefit humankind. There is no denying that advances in such areas as artificial intelligence (AI), big data, robotics, personalized medicine, autonomous systems and renewable energy promise a better tomorrow. This list is certainly not exhaustive. Indeed, as global population continues to grow, and as many countries confront an ageing population, technological solutions will become increasingly important to human well-being.

However, on the other hand, technological change also brings forth formidable challenges to society and the environment. Technology not only may be misused intentionally—one only needs to think of the heightened concern about cyber security in this regard—but it may also lead to unintended consequences that are harmful to human beings. In a world that is increasingly reliant on technology, change will disrupt not only established socio-political and economic patterns, but also human relationships and values. The future of work is going to be quite different from what it is today. The future of learning also raises important questions—what does it mean to be an educated person in the age of artificial intelligence? In a future where human enhancement or augmentation becomes a matter of choice, and not just by necessity, and more generally in a world where the boundaries between human and machine intelligence become less distinct, there is a need, indeed, to reflect on the very meaning of being human in the age of the 4th Industrial Revolution.

To focus attention on these issues, in my university we have recently established the NTU Institute of Science and Technology for Humanity (NISTH). NTU has considerable strength in engineering and science. It also has a new medical school, which is a joint venture with Imperial College London; a well-known business school; and a thriving College of Humanities, Arts, and Social Sciences, which is now the second largest college at NTU, after Engineering.

Within the College of Humanities, Arts, and Social Sciences, there are at present four Schools and a Graduate Centre. They are the School of Humanities; School of Social Sciences; School of Art, Design & Media; Wee Kim Wee School of Communication and Information; and the Nanyang Centre for Public Administration, which has been providing graduate and executive training for senior government officials from China and ASEAN for over two decades. NTU is also home to the National Institute of Education, and the Rajaratnam School of International Studies, which is recognized especially for its research into security issues. Interdisciplinarity may be said to be a hallmark of NTU education and research, especially in the College of Humanities, Arts, and Social Sciences.

The NTU Institute of Science & Technology for Humanity seeks to bring together academia, industry, government, and non-profit organizations in addressing the impact of technology on society, with the view of ensuring that technology serves its intended purpose, creating value for humanity. NISTH sets its sight not only on research and education, but also on thought leadership that bears on innovation and policy, as well as generating informed public discourse.

NTU has announced an ambitious Smart Campus plan, which aligns closely with Singapore's Smart Nation initiative. NISTH will leverage the strengths of NTU in technological innovation, as well as in social science research, education, and policy studies, and address the many challenges that invariably arise from the adoption of new technologies in society. Being at the leading edge of technological innovation may be a necessary condition for the development of a smart city, but it is certainly not a sufficient condition, for the smart city project is predicated on the ability to harness the power of technology in enhancing sustainable development and the flourishing of humanity, which depends on meeting other conditions.

Initially, as its main research focus, the Institute has identified three interdisciplinary areas that cut across different technology domains. These are 1) Responsible Innovation; 2) Governance and Leadership in the 4th Industrial Revolution; and 3) New Urban Asia.

The ethical implications of technology should not be an afterthought. The unenviable pattern of new technologies leading to new vulnerabilities and harmful side effects reflects serious shortcomings in the process of innovation itself. The idea of Responsible Innovation seeks to encode the human experience into the process of innovation and to ensure that innovation is responsive to real human needs. Technology firms are now working with designers, behavioural psychologists and cognitive neuroscientists to enhance technology use. The question is the extent to which ethical considerations can also be embedded in the algorithms that shape artificial intelligence. If they are built into the codes, how would they affect transparency and predictability

that are critical to the development of AI?

As both the range and speed of technological development escalate, governance of science and technology will also become increasingly complex and challenging. Inequality is likely to intensify, and technology alone will not be able to bring about the kind of future we wish to build. Negotiating between competing interests and balancing benefits and risks will be instrumental to sound governance that strengthens the foundation of sustainable and inclusive social development.

In addition, advances in AI and data analytics are transforming the processes of decision making itself. Whether in the public domain or the private sector, technology is redefining the very notion of informed judgment, strategic decision and leadership. This has implications for not only policy-making but also education, as the attributes and requisite skills of an educated person will also evolve with advances in technology. I will come back to this point shortly.

Technology is fast transforming the urban landscape of Asia. Autonomous vehicles, underground spaces, and smart city systems, to cite but some of the more conspicuous examples, will shape the urban environment in the not too distant future. Beyond infrastructure, how do human beings relate to one another and the environment, and the kind of community that will emerge as a result will need to be considered. If the influence of technology is pervasive, it may be prudent to recall that the word “influenza” shares the same root. Will the new urban Asia be highly stratified, or is it possible to infuse the web of human relationships now pervaded by technology with the kind of caring community spirit, or what is called in Singapore, “*kampong* spirit” that ensures social urban health in 21st-century Asia? Comparative studies of urban centres, whether metropolises or smaller cities, should shed light on the direction of change and development in urban Asia.

NISTH is an interdisciplinary hub and welcomes international collaboration. For this discussion, however, let me now conclude by offering some observations on one aspect of the multi-dimensional project of technology for humanity—that is, the future of learning, especially with reference to the Humanities and Social Sciences.

Today, we are familiar with the phrase, “technology-enhanced learning.” Flipped classrooms and blended learning are no long a novelty. At NTU, for example, virtual reality, augmented reality, 3D printing and data analytics are transforming medical education, where students do not attend formal lectures and where technology-based interactive learning is the norm. This trend is going to accelerate, extending to all disciplines. It is perhaps not difficult to imagine that learning in the future may take place anytime and anywhere, where a personal knowledge assistant would be available at all times. However, the point is not so much the modes of learning, as the learning outcomes we seek to deliver.

The students coming into the university in the future will have grown up in a technology-pervasive environment, and the work environment they face after they graduate also will be very different. Innovation will take on an even more pivotal role as the main driving force of the future knowledge economy. The technology quotient of a person or population will likely correlate with their level of economic health. If this is a reasonable assumption, we will need to review the kinds

of habit and discipline of mind that we seek to inculcate in our students. A well-rounded education in the 21st century should enable them to navigate with confidence the technological domain. A good level of digital literacy will be required, regardless of their chosen concentration. For this reason, NTU has introduced digital literacy as a core subject for all our students. In this context, the Humanities and Social Sciences will need to reach out across disciplinary divides to ensure that the human experience is not neglected in the cultivation of literacy in the age of artificial intelligence and the 4th Industrial Revolution. In so doing, the Humanities and Social Sciences can then begin to assert its role in the shaping of the technology agenda.

The ability to acquire and create knowledge based on valid information and analysis is clearly important. Possessing the requisite skills for specific kinds of work is equally important. However, important as they may be, being educated goes beyond information processing and the acquisition of skills. Learning is also a process of socialization and personal growth, through which individuals learn to make judgments, build and nurture relationships, manage complexities, and assume responsibilities.

It seems clear that we do not wish to come to a stage where technology defines humanity. It cannot be assumed that the gain in technology quotient will lead to a corresponding increase in emotional intelligence. On the contrary, a deficit in the latter in the age of artificial intelligence cannot be ruled out, which will have significant potential impact on the social fabric.

The so-called “soft skills” have been emphasized in the current discourse on education, and rightly so. Whether in terms of critical thinking, communication, or the ability to work with people, they are obviously important. Ethical awareness and cross-cultural sensitivity are certainly also among the learning outcomes we would want to achieve. We may need to add or increase the measure of digital literacy as an ingredient into the broader literacy soup, but this does not mean that other ingredients can be displaced. As in cooking, the desired outcome depends on how well the different ingredients come together to form a well-balanced education.

Beyond the so-called soft skills, I think there is another point that needs to be made. If technology is measured by precision and efficiency, human cognitive and affective intelligence is more complex, as the social fabric of humanity is interwoven with threads of desire and relationships, which give the distinctive texture of both joy and suffering, nobility and baseness, and the rich interplay of yin and yang in human existence. These are not necessarily hard opposites, but rather more often than not a mix of both in varying measures and intensity, where we would find in one traces of the other. The Humanities and Social Sciences compel us to reflect on the bundled values that constitute the human algorithm. The Humanities and Social Sciences aim to deepen not only our understanding of history, culture, and society, nor do they merely act as custodians of tradition; rather, the kind of understanding we seek should lead to a deeper self-understanding. Perhaps even more so than the teaching of soft skills, this will continue to mark the value proposition of the Humanities and Social Sciences.

Shaping technology from within, the Humanities and Social Sciences will be in a stronger

position to help improve the human condition. This is not by eliminating inefficiency or imperfections, which would amount to reengineering the human condition by removing uniquely human characteristics, but by understanding human relationships and mediating between competing interests and values. The ability to weigh between efficiency and human value such as respect and empathy will be critical to future human development.

To meet the changing demands of learning, and this is the last point I will make, there may be a need to question the disciplinary boundaries that shape the Humanities and Social Sciences today. Academic disciplines are themselves artificial constructs, and some of them are in fact of recent provenance. Their growth and development are often shaped by financial and administrative considerations, by power concerns. Knowledge does not grow well in insularity, and disciplinary interests may not be conducive to cultivating a holistic critical imagination that is adept in managing not only innovation and disruption, but also the complexities of the human heart, as well as the network of relationships that define human existence. In the final analysis, technology for humanity should properly be the focus of the Humanities and Social Sciences in the 21st century.