

Drones, AI and getting undergrads ready for great disruption



There are many things which keep us lecturers awake at night: overdue research paper submissions, unrealistic grade expectations by students, concerns about the future employability of our graduates in a Vuca (volatility, uncertainty, complexity, ambiguity) era and so forth.

A related and very exciting challenge is the endeavour to keep the curriculum relevant, attractive and future-ready as we enter the defining stage of what has been termed as “big bang disruption” (coined by Mr Larry Downes and Mr Paul Nunes in their 2013 Harvard Business Review article). While this is easier said than done, institutions of higher learning are stepping up efforts to create new learning opportunities and experiences to support the next generation in achieving their full potential.

Against this backdrop, we recently launched an inter-disciplinary course on emerging technology at the Singapore Management University, focusing on unmanned aerial vehicles (UAV or drones), robotics, and artificial intelligence (AI). One key learning outcome is to enable students to appreciate, in a multi-disciplinary setting, the huge business potential of emerging technology in diverse areas—such as logistics, supply chain management, transportation, search and rescue, military, and scientific studies. Another is to sensitise learners to the regulatory and ethical-moral issues associated with new technologies.

Estimates by consulting firms suggest that the global market for commercial drone technology applications alone, which currently stands at about US\$2 billion (S\$2.8 billion), will increase to about US\$120 billion by 2020 as a result of regulatory progress for UAV operations, effective legislation, lower costs as well as new, innovative business models.

In September 2014, an unmanned DeutschePostDHL parcelcopter made headlines by successfully flying (outside of the pilot's field of vision) from the city of Norddeich in the north of Germany to the NorthSea island of Juist –to deliver some urgently needed goods, such as medications.

In December last year, Amazon successfully delivered items to a customer in the English countryside near Cambridge (in a drone test-flight zone) shortly after it had received the online order.

Other drone applications include aerial photography and filming, 3D imagery, surveying/mapping, crop control, inspections of offshore systems, pipelines, wind towers, buildings, and verifying insurance claims. Similarly, new technology consulting firms have emerged specialising in market research and analytics for drones. Drones are also boosters for the tourism industry.

Last year, Dubai hosted the first World Drone Prix, a drone race with US\$1 million in prize money. Later this year, the 2nd Commercial UAVExpo will take place in Las Vegas, with more than 100 exhibitors.

Examples of drone applications in Singapore include:

- I. The research-driven, multi-data approach by the Future Cities Laboratory of the Singapore-ETH Centre to create reality-based 3D models of very high quality, using drone photogrammetry;
- II. Efforts by the Urban Redevelopment Authority to capture aerial images and videos of Jurong Lake District and the Rail Corridor so that stakeholders can better visualise and assess future development plans;
- III. Safer and more efficient fire-fighting approaches by the Singapore Civil Defence Force;
- IV. (iv)The use of aerial and terrestrial drones as waiters in restaurants;
- V. Commercial photography and recreation; and
- VI. Environmental monitoring and infrastructure inspection, for example in the oil and gas sector.

Besides goods, drones can autonomously transport people. The possibilities are immense. Could Singapore become a hub for socially innovative Drones For Good competitions?

The history of industrial robots goes back several decades, with the first robotics patent granted in 1961. Today, robots are used in assembly lines to manufacture all types of products. Robots have also found their way into homes as autonomous vacuum cleaners, or in the form of companion (love) robots.

Although AI earlier failed to meet its grand promises in the 1960s and 1970s, it has since grown by leaps and bounds. Rudimentary autopilot features in aircraft made their appearance as early as 1912. In 1997, IBM's Deep Blue supercomputer beat chess grandmaster Gary Kasparov at a match –the first time a machine beat a world champion chess player. This year, Libratus, an AI system built by researchers from Carnegie Mellon University, played in a poker tournament against four of the world's top professionals – and won. Perhaps a group of undergraduates from our universities could write AI software to play mahjong against the world's best players?

The nexus of inspiring technology and smart engineering, innovative business approaches, as well as robust law and regulatory policies, will have to be adroitly managed and synthesised if emerging technologies are to be successfully test-bedded in Singapore.

Trust is a vital substratum if emerging technologies are to be embraced by stakeholders and become a part of our lives. This technological ecosystem of the future, comprising hardware,

software and mindset, is necessary if Singapore's innovation economy is to be taken to a higher plane. One challenge in exploiting the commercial opportunities of emerging technologies is the development of innovative business models to monetise UAV technology or smart robotics/AI applications. After initial euphoria from the triumph of machines over the best human players, technology still needs to be brought to market, and business leaders need to strategise how best to go-to-market with such a "game-playing" technology. While we educators facilitate this by utilising tools such as the business model canvas, deep learning requires various complementary skills.

In the areas of unmanned aerial vehicles, robotics and AI, there is a lot of scope for interdisciplinary collaboration and mixed teams. Social science students can provide the background on how "social" a robot needs to be. Engineering students can build the mechanical movements controlled by electrical signals and AI with speech recognition software developed by information technology students.

Business management students can find creative ways to market new types of robots, for example, social robots, after first learning to appreciate the technical details, market opportunities and societal concerns about a novel technology. Having a mixed group of students representing different disciplines can help to avoid blind spots such as difficulties in realistically assessing the (future) commercial value of this new technology in view of current weaknesses and threats, such as regulations, fear of (technology) failure, and inadequate attention to ethical concerns.

The headlong rush to exploit emerging technology tends to result in ethical and regulatory issues being given short shrift. The prototypes of driverless cars built by Google, Tesla, BMW and others have enough built-in AI to free drivers from routine tasks like cruise control, keeping in lane and braking when the car gets too close to the vehicle in front. But what happens when there is an accident involving a driverless car, or when drones violate privacy rights? That is where ethicists, insurers, lawyers, policymakers, transport specialists and business planners need to offer their collaborative expertise. Sensitivity to these technology-related issues can help ensure that stakeholders' interests and concerns are adequately dealt with, ensuring their receptivity to emerging technologies. In line with Singapore's quest to become an innovation-led country, current talent gaps need to be closed. Using new technologies such as UAV technology or robotics as examples, we posit that more collaborative partnerships need to be formed between experts and novices with and within institutions of higher learning, technology/IT, business, ethics and law to ensure that learning outcomes are needs-based and aligned with the country's long-term innovation agenda, a key feature in the Committee on the Future Economy's report.

At his National Day Rally speech last year, Prime Minister Lee Hsien Loong noted that disruption is the "defining" challenge to the economy. And as Finance Minister Heng Swee Keat stressed during the Government's Budget statement earlier this week: "These deep shifts around the world will create new challenges but also open up new opportunities for many years to come. We must understand these shifts and do our best to adapt and thrive."

One of the items highlighted in the Budget 2017 speech is the "Attach and Train" programme, which will help workers find jobs in new growth sectors through training or internships in industries with growth potential, but where companies may not be ready to hire yet. What is clear is that a collective effort is required to nurture resilient individuals and companies, enhancing their relevance as well as the economy's. There is tremendous scope for Singapore to enhance its innovation capabilities and promote entrepreneurship. To do this, not only do our universities need to be rewired, Singapore's societal norms also need to shift.

Such massive mindset changes do not fall neatly into just one domain. The combined expertise of engineering/IT, strategic business management, social sciences, ethics, organisational psychology and law is required to make our students future-ready

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