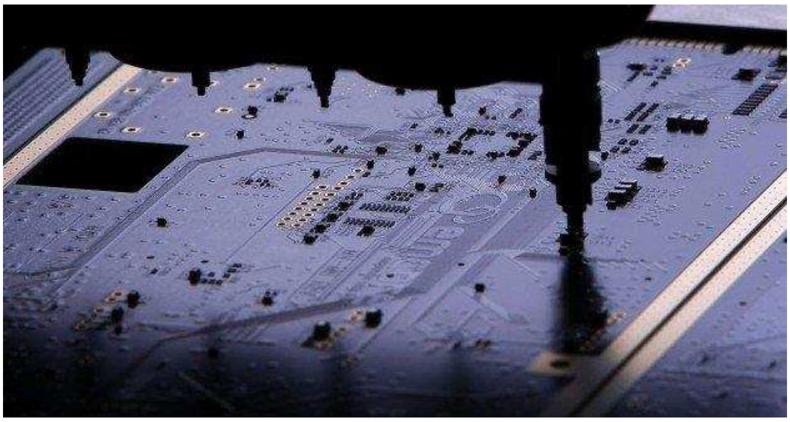
What are the ethical implications of emerging tech?

By Nayef Al-Rodhan



In the past four decades, technology has fundamentally altered our lives: from the way we work, to how we communicate, to how we fight wars. These technologies have not been without controversy, and many have sparked intense debates, often polarized or embroiled in scientific ambiguities or dishonest demagoguery.

The debate on stem cells and embryo research, for example, has become a hot-button political issue, involving scientists, policy-makers, politicians and religious groups. Similarly, the discussions on genetically modified organisms (GMOs) have mobilized civil society, scientists and policy-makers in a wide debate on ethics and safety. The developments in genome-editing technologies are just one example that bio research and its impact on market goods are strongly dependent on social acceptance and cannot escape public debates of regulation and ethics. Moreover, requests for transparency are increasingly central to these debates, as shown by movements like Right to Know, which has repeatedly demanded the labelling of GMOs on food products.

Ethical and regulatory challenges

The World Economic Forum's list of top 10 emerging technologies of 2015 includes those that aim to resolve some of the ethical debates posed by an earlier generation of technologies, as well as others that will bring about new ethical and regulatory challenges. The notion of "emerging" technology does not necessarily mean that all such technologies are new or revolutionary by themselves. Some have already been around for years or, in various forms, for decades (e.g. fuel-cell vehicle, artificial intelligence, digital genome, additive manufacturing methods). However, they are now transitioning to a new phase, becoming more widely used or incorporated in consumer goods. In one way or another, all these technologies are bound to gain more ground in the years to come.

Precise genetic engineering techniques, one of the highlighted technologies, will likely solve some of the main controversial elements in the GMO debate, for example the fact that genetic engineering was neither precise nor predictable. The range of procedures associated with GM crops is precise in the initial process of cutting and splitting genes in the test tubes. But the subsequent steps are uncontrolled and some mutations can occur and alter the functioning of the natural genes in potentially harmful ways.

A precise technique that would achieve greater accuracy and greater predictability over genetic mutations is, of course, a net improvement on conventional GMOs. It is, however, critical that this technique is properly studied and implemented in a sustainable way and that it doesn't just give renewed legitimacy to genetic engineering in agriculture.

More accuracy is also expected in the operation of drones with the adaptation of the Sense and Avoid equipment. This will have unequivocal security benefits, helping to avoid collisions of drones with other drones or piloted systems.

The critical offshoot of this innovation is that it will encourage and enable the operation of a larger number of drones, a development which can be both welcomed (for instance, China flies drones to help fight pollution) and anticipated, as the growth in dangerous drone flights around populated areas appears to be developing ahead of regulations.

Autonomous systems, artificial intelligence (AI) and robotics, while already decades-old technologies, will continue to expand their functionalities and enter new eras of continuous specialization. More intuitive, emergent AI could change speech and conversational software with unprecedented precision, helping millions of people and also redefining the way we command and interact with computers.

Robots as intelligent as humans

New-generation robotics will increasingly have more autonomy and capacity to react without pre-programming, which complicates all current debates on robotics: the trust and reliance invested in a robot will have to be greater, bringing us closer to the point of being on a par with robots. Neuromorphic chip technology further illustrates this. This is among the most revolutionary developments in AI and a radical step further in computing power. Mimicking the intricacies of the human brain, a neuro-inspired computer would work in a similar fashion to the way neurons and synapses communicate, and potentially be able to learn or develop memory. This would imply that, for instance, a drone equipped with a neuromorphic chip would be better at surveillance, remembering or recognizing new elements in the environment.

However, immediate ethical red flags emerge: building neuromorphic chips would create machines as intelligent as humans, the most superior and intelligent species in the universe. These technologies are demonstrations of human excellence yet computers that think could be devastating for our species and, as Marvin Minsky has put it, they could even keep humanity as pets.

The interest in smart machines is now also pursued in additive manufacturing methods, which are increasingly integrating smart materials into manufacturing. These materials could adapt, change properties, interact or respond to their environments. With 4D Printing, which takes into account the transformation that occurs over time, some materials will adapt and repair by themselves, without maintenance, or they could be pre-programmed to disintegrate on their own. This will raise new questions of standardization, traceability and copyright.

More radical disruptions will occur once the technology transitions to the organic world, making it possible to assemble biomaterials that evolve and develop on their own, design cancer-fighting robots that would release antibodies only in contact with cancerous cells, etc. The moment of the print button for biology is nearing. Effectively, this could also mean that in a not too-distant future, smart pharmacology will permit us to receive a constant supply of anti-depressants or neuro-enhancers every time our dopamine level drops. The ethical consequences of such developments should be thought through. Having our emotions controlled in detail by smart machines will pave the way for dangerous forms of dependences and new understandings of our humanity and the emotions that define us.

Genome-based treatment, based on wider and cheaper availability of genome data, will provide new ways to customize the therapeutic protocol and enhance our control over diseases and medical treatment. The speed, accuracy and costs of genome-reading have changed dramatically in just a matter of years: a decade ago, this process was a billion-dollar effort, while today the price has dropped sharply to around $8,000. In cancer treatment, for instance, this will allow transitioning from broad-spectrum chemotherapies to more individualized diagnosis and targeting of specific malfunctioning genes. As we are truly starting to gain more precise tools to fight life-threatening diseases, a range of other issues arise. Pervasive global inequalities will still prevent millions of people from enjoying the benefits of such treatments, even in a context of decreasing costs of genome sequencing. Furthermore, a range of security and privacy risks associated with data storage of genome data will invariably arise and require protective mechanisms, especially as such databases are often shared for security reasons (e.g. between international police forces), increasing the possibility of hacking.

Inevitably, the emerging technologies of the future will redefine our understanding of biology, the material world and manufacturing. The implications will further extend into geopolitics and global balances of power. Fuel cell vehicles are finally expected to make their way to the market and reduce dependency on oil or emissions that contribute to climate change. In the long term, this will accentuate the vulnerability of oil-dependent economies and recalibrate geopolitical relations. Recyclable thermostat polymers, reportedly discovered by accident, will dramatically change fabrication and manufacturing, leading to new standards in industries. Globally, the advent of distributed manufacturing is bound to lead to a reassessment of the meaning of value chains and infrastructure: rather than ship parts of a given product, some companies will simply trade information, leaving it to the customer to finalize the manufacture of the product. A suite of other technologies, such as 3D printing, informatics and robotics are enabling a paradigm shift to a dematerialized future with endless possibilities for customization.

Changes ahead

The Forum’s list of top 10 emerging technologies for 2015 alerts us to important changes on the horizon for all sectors. As always, we must welcome innovation and the benefits it brings us. But we must also remain committed to sustainable development, taking into account issues of inequality, human dignity and inclusiveness. Finally, this year's top emerging technologies also remind us of the importance of political commitment. Take the example of the transition towards fuel cell vehicles: it will require huge infrastructural adaptations and conversions. In fact, it's estimated that if the US government spent the same putting a man on the moon ($100 billion in today's dollars), the shift to hydrogen-powered cars and gas stations that pump hydrogen would be significantly eased. Often, the technology itself is actually available, but it takes a massive exercise of political will to bring about change.

Some technologies might progress independently of political support. But good governance, examinations of dual-use risks and ethical considerations must still remain guiding posts at all times. Ultimately, how we approach the regulation of emerging technologies will inevitably have wide implications – not only for security and ethics, but for our definition of human dignity and equality of individuals.

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Image: A high speed robot places components on to a circuit board at the the VAS manufacturing facility in San Diego, California April 14, 2009. REUTERS/Mike Blake