Technological Advances and National Security

By Cung Vu

Synopsis

The pace of technological advances demands that national security policy and decision makers understand the relationship between technology and security. They must also be conversant with and functional in the various technological domains relevant to national security.

Commentary

WHO COULD ever imagine that an unmanned aerial drone could detect and strike targets thousands of kilometres away or that a stroke on a computer keyboard could paralyse infrastructure remotely. These scenarios highlight the fact that technology has fundamentally altered the national security landscape.

During the Cold War, Vietnam War and Iraq War, the US focused on strategies to develop high-tech systems that could give US military forces qualitative advantages over adversaries such as the developments of global positioning systems, stealth, infrared night vision, unmanned aerial vehicles and so on. Because of globalisation, many technologies once available in certain organisations or countries, are now available almost everywhere and could be developed and built from off-the-shelf components. Apart from kinetic weapons technology, biological and chemical technology now poses a different kind of threat.

Technology and its applications

It is important to emphasise that technology itself is value-neutral. Depending on how it is used, technology could either enhance our national security or have an adverse effect on it. Some fundamental technologies could be divided into broad domains or categories.

Nanotechnology: A technology conducted at the nanoscale, nanotechnology is where one nanometer is equal to one billionth of a meter; at the nanoscale, materials behave differently from bulk properties. Now nanotechnology plays critical roles in almost all disciplines, from research to engineering to product developments. Nanotechnology is used to produce nanomaterials, smart materials, nanoelectronics, nanosensors, nanodevices, nanomedicine and so on.

Nanotechnology has numerous military applications. Having excellent mechanical, chemical, thermal and electrical properties, carbon nanotubes and nanomaterials have been incorporated in many parts of vehicles and aircrafts to make them lighter and stronger. Nanoelectronics makes it possible to create ever-smaller computers for use in mission planning and rehearsal, command and control on the move, battle visualization, network communications and signals processing. Nanosensors could be used to detect hazardous chemical and biological agent in-situ with great accuracy in air or water.

Biotechnology: Biotechnology is a broad discipline in which biological processes, organisms, cells are exploited to develop new technologies and products that help improve our lives. Since prehistoric times, humans have used yeast to raise bread dough and to ferment alcoholic drinks, and bacteria to make cheeses and yoghurt. When scientists learned how to interpret and remix the genetic code, they began taking genetic information responsible for controlling specific features from one organism and splicing it into another. This genetic engineering technique has enabled researchers to develop new kinds of flora and fauna at an accelerated pace.

The technology that may revolutionise medical care by providing personalised drugs could also be used to produce more lethal biological weapons. The events of 9/11 and the post-9/11 anthrax letters brought much attention to such biological threats.

Due to recent breakthroughs, scientists are now able to generate new DNA sequences without a template. By combining these breakthroughs with modern engineering principles, scientists can now use digital technology and laboratory materials to create cells whose DNA is formed from non-natural amino acids, paving the way for the possible creation of novel life forms.

This has very grave implications. In 2014, the Ebola outbreak which killed more than 10,000 people was a warning. In an interview earlier this year, Bill Gates stated that according to his modelling, because 50 times more people cross borders today than they did back in 1918, the next Spanish flu-like epidemic could kill 33 million people in a matter of 250 days.

Information and Computing Technology (ICT): The development and implementation of new ICT continue to have a revolutionary impact on our work and lives. Interests in personal habits, speed, and mobility have served as the impetus for discovery. Due to the increase in devices that support people's ability to network digitally, the amount of information online has skyrocketed. Emerging technologies and capabilities that have been or are being developed include those geared towards sensing, networking, data management, and social media.

Cyberspace and all aspects of ICT continue to expand so it is hard to predict even what the near future might hold. Because of these advances, one should be thinking of and be prepared for the consequences "IF" our adversary could exploit ICT to destroy nuclear power plant cooling systems, silence GPS satellites, disable large portions of the military Internet, disrupt financial and banking systems or shut down a national electrical grid. These are just a few scenarios.

Cognitive Science: Technologies being commercialised could enhance or even supplant human capabilities. Advances in the development of human interfaces, control algorithms, and power sources - among other components - are making robots viable for personal and industrial use alike. Recent improvements in artificial intelligence and the supporting technology holds great promise in terms of reducing labor, risk, and health care costs while improving decision making, efficiency, and health care quality.

Technological paradigm shift and its implications

Accelerating technological change is affecting every aspect of global civilisation. Policy and decision makers must be prepared for these outcomes. In the future, the organisations or countries that come out on top will be those that have the ability to accurately anticipate and adjust accordingly to a perpetually shifting global landscape.

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