

## Book Review

# Technological Revolution and the Emerging Military Environment

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Ajey Lele

*Disruptive Technologies for the Militaries and Security,*  
Singapore, Springer Nature, 2019

**T**echnological disruption has happened at various points of human history, with transformative consequences. As the second decade of the 21<sup>st</sup> Century is coming to a close, a new wave of technological disruption is being witnessed. The emergence of the 'Fourth Industrial Revolution' has triggered this wave of disruption. Its impact is not just restricted to the field of technology, but is also fast expanding its footprints across various other domains – political, economic, societal and cultural. The military domain seems to be possibly the most affected, at a time when global geopolitics is witnessing the return of great power rivalry.

Ajey Lele's significant new study-- *Disruptive Technologies for the Militaries and Security*, which is part of a series on Smart Innovation, Systems and Technologies by KES International (UK), is therefore most timely. The book has dealt in detail with the individual technological components which are powering the recent surge in disruption, and its potential impact on the military domain and the international security scenario. Across the world, advanced militaries are trying to adapt their systems and doctrines to these new technologies. The type of comprehensive assessment made in the book is much needed given the early stages of development of the new technologies, and their increasing induction into the military forces of major countries. Moreover, the author has attempted to analyse the phenomenon through various conceptual and theoretical prisms rather than being merely descriptive.

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Drawing from the realist theory of International Relations, which focusses on the natural tendency of the state to seek power, the author has explored the role of technology as an enabler for converting resources into power. Technological advances are found to have a key role in enhancing a state's power. This is quite significant to understand the contemporary global context. The author has also linked technology to the offence-defence balance among states with technology as a factor which could tilt the balance. The author has also explored debates such as the ones between technological and social determinism, and the relationship between globalisation and technological change and the question of causation. Reflecting on the laws for technological growth, the author argues that the time lag between the technological design and its implementation is markedly reducing. Conceptually, the author has highlighted the difference between disruption and innovation. Though there is a thin line between them, it has been noted that all disruptions are innovations, but not always the other way round.

Disruptive technologies have been defined as those which suddenly and unexpectedly displace an established technology from the market. In the military domain, this refers to the technological development that significantly changes the rules or conduct of conflict within one or two generations. Globalisation has helped in the faster diffusion of disruption, which has led to a reduction in response time for the military to adapt. Moreover, the ongoing disruption in the military domain, triggered by emerging technologies, has taken an approach fundamentally different from the traditional one. The traditional approach was to multiply existing systems so that more soldiers can be armed; the current one seems to be taking the opposite path by reducing the role of the human element. This conceptual and theoretical assessment provides an effective foundation for the detailed discussions on the disruptive technologies which follows in the book.

One of the emerging technologies which could prove disruptive in the near term are hypersonic weapons. Surpassing the speed of sound has been an objective pursued ever since the dawn of the age of flight. Hypersonic flight is characterized by a speed more than five times the speed of sound. With the advent of missiles as a premier platform of force projection by major militaries across the world, the quest for hypersonic speeds have been accelerating. Currently, the US, Russia, China and India are at the forefront of developing weapons which could achieve this speed. Hypersonic Glide Vehicles, due to their high speed and manoeuvrability, can evade missile defences, and are therefore a concern for countries with operational missile defence systems. Hence,

they have the potential to disrupt the strategic stability existing between the major nuclear armed rivals.

Some of the new materials and manufacturing systems are also identified by the author as disruptive in nature. Materials like Graphene, Silicene, Germanene, Phosphorene, Antimonene, and Stanene have unique properties which combine contradictory characteristics like high strength and low weight. These could radically alter industries such electronics, computing, aerospace, and biomedicine, with possible implications for the military. Shape memory alloys could remember and revert to their prescribed shapes in particular environmental conditions; self-healing materials could repair themselves after suffering wear and tear. Additive Manufacturing methods like 3D Printing, which creates products by adding rather than removing raw materials have many benefits which could revolutionise manufacturing of defence components. Apart from reducing wastage and associated costs, it could also mean that manufacturing could be transplanted to the battlefield, and rare spare parts can be made as per demand. However, this also raises issues regarding proliferation of weapons due to the possibility of design blueprints getting transferred online away from physical regulatory frameworks for technology transfer. Violent non-state actors also seek to benefit from these technologies.

Environmental change is fast becoming an issue for the militaries, which have been attempting to acquire renewable energy systems, which can be both environmentally friendly as well as portable. The author has rightly emphasised that the armed forces are not only the major users, but also the protectors of energy resources. With new developments in solar, wind, hydel, geothermal and bio energy technologies, the powering mechanisms of the militaries will also be radically transformed. In the field of genetics, the next generation sequencing techniques are poised to have a tremendous impact on not just medical, but also the military domain. With such emerging technologies, the possibilities are becoming wide open for the generation of new pathogens or bioweapons with higher transmissivity and high communicability, for which there are currently no defences. On the other hand, these technologies are set to create genetic benchmarks for recruitment of highly effective military personnel through genomic screening.

Perhaps, no other emerging technologies have as much potential over the long term as the products of the Fourth Industrial Revolution (Industry 4.0), which could lead to a possible evolutionary leapfrogging of the military. Out of these, Artificial Intelligence (AI) seems to be the most significant. Though the concept is at least half a century old, it

has gained critical momentum only in the past decade. It is defined as the simulation of human intelligence processes by machines, especially computer systems, including learning, reasoning and self-correction. AI seeks to ultimately replace humans from the Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) systems in the military. Moreover, it also seeks to eventually grant complete autonomy to force application by inserting advanced AI into killer robots, called Lethal Autonomous Weapon Systems (LAWS). This has raised concerns regarding the ethical dimensions of such LAWS, which ultimately may keep humans out of decision-making and may possibly even outmatch and turn against them. Though initially imparted to bomb disposal systems, AI has seeped into numerous platforms like drones, air and missile defence systems in a limited and varying manner.

Other products of the Industry 4.0 have also been explored by the author, including Virtual Reality, which is increasingly used for training soldiers. With an exponential rise in the generation of digital data, Big Data is finding growing applications in the military and security domain, especially with regards to intelligence gathering. With more and more Big Data being generated, there is a growing need to store these voluminous yet strategic valuable quantum of data. This is where Cloud Computing is gaining significance. Major powers are building their own secure clouds for strategic real time storage and retrieval purposes, at the same time becoming more and more mindful of their critical cybersecurity vulnerabilities. The author has also analysed the impact of Internet of Things, which may lead to the generation of Internet of Military Things and Internet of Battle Things in the military domain. The emerging blockchain technology, on the other hand, promises the possibility for creating secure databases relevant for the military.

The author concludes the book with an assessment of these disruptive technologies on the future of disarmament, arms control and arms race. The disruptive technologies outlined in the book, especially hypersonic weapons, LAWS, 3D printing, blockchain and next generation genomics can have game changing effects in this regard due to ethical issues and their ability to bypass existing agreements and regulations.

The author, however, cautions that any simplistic assessment at the current juncture, when these technologies are at their embryonic stages in the military domain, is to be avoided. Therefore, understanding the next possible stages in their evolution will be key to proving their real disruptive potential. This book is definitely a step in that direction.