The Institute for Peace and Unification Studies Seoul National University

IPUS HORIZON | No. 3 (11 January 2021)

Science, Technology and Peace

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There has been much discussion about how technology has changed the dynamics of war, and how it has influenced the contest for supremacy. Jared Diamond's "*Guns, Germs and Steel*" explains how the modern inventions, namely guns and steel, destroyed the agrarian society of the New World. Lynn White argues in "*Medieval Technology and Social Change*" that it was the stirrup that allowed the mounted knight to engage in shock combat and made feudalism possible. Although these are under the perspective of technological determinism, it is still a known fact that technology has changed the structure of war and the dynamics among nations. Admiral Yi Sun-sin's victories in the legendary battles owe much to the cannon that the Japanese did not have. The shock of the Black Ships(Kurofune) and the invasion of Korea by the Western power in the late 19th century represent the technological advancement of the West. The two World Wars are the classic example that reflects the relationship between technology and war. Warplanes, chemical weapons and tanks were systematically introduced in World War I. The significance of technology for use in warfare became more salient in World War II. Rocketry, jet aircraft, radar, field expedient antenna kit, and electronic computers were developed in wartime and played a crucial role. Above all, it was the atomic bomb that prompted the surrender of Japan who strived to put up a fight even after Berlin fell to the Allies.

Even today, 75 years after the war, the Manhattan Project, which produced the first nuclear weapons, still plays a big part in defining modern scientific technology and society. First, the Manhattan Project was the first case in which the government systematically invested resources and mobilized industry-academic institutions to develop a targeted technology. It was a state-led mission-oriented research and development project, the first of which loaded

the victorious nations with an outstanding achievement. Second, a belief was formed that scientific knowledge, once regarded as a purely fundamental study without any practical use, could be transformed into a technology with formidable power (which could be military or commercial) through appropriate applied research and development. Mass-energy equivalence formula from Albert Einstein's theory of relativity and nuclear physics from Ernest Rutherford and Marie Curie's study of radiation have now become such force that threatens the survival of mankind. As the end of the war drew near, American scientists, concerned about the suspension of scientific research support which was part of the national mobilization system during the war, argued that science would still be of great use at the national level. In a report titled "Science, the Endless Frontier", Vannevar Bush, then head of the Office of Scientific Research and Development(OSRD) and particle physicist, stipulated the advancement of science research as the "Federal Government's new responsibilities", for the scientific progress is essential for national security, public health and public welfare, and stressed the importance of federal spending on promoting basic research. This report pressed for the creation of the National Science Foundation(NSF), which expanded worldwide as a Western scientific support system along with the Research Councils of the United Kingdom.

The legacy of the Manhattan Project as a mission-oriented research and development project led to the Apollo program in the Cold War. During the Cold War, a period of regime competition between capitalism and communism, the technological superiority symbolized the regime's superiority. Technology during this period of 'pride game' was dominated by Big Science. The scale that outstrips the adversaries and preoccupancy mattered more than the efficiency and effectiveness of financial investment in research and development. The relationship between technology and the Cold War seemed to have come to an end with the fall of the Berlin Wall, but has recently revived as a Tech Cold War between China and the United States. The US-China tech cold war has turned hot as the two great powers battle over the future of economy and national security. What has appeared on the surface is Huawei's backdoor access to mobile networks. Yet, hidden beneath the surface lies the Western liberalist agenda that does not tolerate China's overtaking the semiconductor industry, which holds the key to achieving breakthroughs in everything from big data and artificial intelligence(AI) to hardware infrastructure.

Meanwhile, Japan's economic recovery in the 1950s was based on the innovation in the manufacturing sector. Japan's rapid progress in the automobile industry with the invention of transistors, followed by the rise of the electronics industry with 'SONY', made Japan the world's second-largest economy by the 1980s. Shocked by Japan's overtaking, European academia closely analyzed Japan's technological success story, which led to the "national innovation system perspective". Basically, it holds that Japan's technological innovation and rapid growth were the result of a national system that resembled wartime mobilization. However, the purpose of the system was replaced by a victory in the global trade competition, not a victory in war. The National Innovation System is a system in which industrial-academic connections are divided under the direction of the government by reviving the authoritative government tradition of the militaristic era and applying to the economic war. This is very familiar to Korea, which has achieved industrialization and economic development by benchmarking Japan and has already overtaken Japan in some industrial sectors. This perspective has become the basis for modern science, technology and innovation policies led by Western European countries, and has been adopted by the Organization for Economic Cooperation and Development (OECD) to form the basis of advanced countries' science, technology and innovation policies. In other words, the two pillars of modern science and technology innovation policy - the United States' linear model and the European system of innovation - originated from the relationship between technology and the state formed during World War II. Are technology and war inseparable?

Science, Technology and Peace

Paradoxically, the relationship between science, technology and peace has rarely been discussed. Science and technology have not been properly addressed from the perspective of peace studies and I shall explain why with the following reasons. First, science and technology have been thought to be serving for wars only. Second, humanities scholars and sociologists that make up the peace studies scholar population have been relatively indifferent to science and technology. Third, there is a lack of evidence that science and technology have contributed to the promotion of peace for mankind. As a result, discussions on science and technology from the perspective of peace studies are still at a rudimentary stage. From what I looked up for

this article, the academic discussion of science and peace currently being held on a small scale is an area of social science that aims to measure the degree and level of peace. The objective indicators of peace include the frequency of disputes and the intensity of inter-group conflicts, and yet the impact of science and technology is too weak to be treated as an independent variable of peace. Although it is difficult to provide the exact empirical evidence required for academic research, I present four hypotheses as an introductory attempt to incorporate science and technology into the discussion of peace studies.

1) The development of science and technology alleviated ideological conflicts.
2) The development of science and technology alleviated racial conflicts.
3) The development of science and technology reduced religious conflicts.
4) The development of science and technology prevents all-out war.

Each hypothesis is further explained below.

1) The development of science and technology alleviated ideological conflicts.

In fact, it is science and technology that has conceived the differentiation of ideology. The scientific revolution in the 18th century triggered modernization and broke down the autocracy and feudalism, which was based on the divine right of kings. The emergence of commercial capital and timely technological advances triggered the Industrial Revolution. The Industrial Revolution shifted the center of productivity from land to factory, from peasants to factory workers, followed by machines and technical innovations, and finally to capital, in which capital goods are purchased and wealth can be reproduced. The upheaval of early capitalism inevitably led to the birth and unity of the working class and to the creation of the communist ideology and socialism adapted to the capitalist system. Ideological confrontation in the 20th century, so to speak, is a product of technological progress.

However, as the victory of capitalism became clear, the sharp ideological confrontation between capitalism and communism has virtually come to an end. The triumph of capitalism

is the triumpth of material civilization and technological innovation. According to Carlota Perez, financial capital is bound to seek new sectors to sustain economic growth, moving from the mature industries to new industries where it may lay the foundation of the next great surge. Take Tesla for instance. Although insignificant in terms of the number of cars manufactured, the market capitalization of Tesla, which leads the paradigm shift in the road traffic system, surpasses the combined market capitalization of all the rest carmakers in the world. Communism overlooked the power of financial capital which combines industry and technological innovation, and thus fell behind in economic achievements, eventually becoming relatively insufficient in promoting public welfare. The capitalist system is superior in linking the achievements of scientific and technological progress to sociological achievements. The Cold War ended with the victory of capitalism, and mankind was able to escape the fear of nuclear destruction. Ideological conflicts have been significantly reduced, and international disputes based on ideological conflicts and national unification wars have disappeared.

The former communist bloc began industrialization, advocating capitalism as an economic system at the least, and the de-ideologicalization of the global economic system accelerated as it coincided with the interests of the developed countries to build manufacturing base by utilizing cheap labor costs in the developing countries. In a world tangled with the global value chain (GVC) that is dominated by the neoliberal trade stance, the possibility of war among GVC members is very slim.

2) The development and science and technology alleviated racial conflicts.

At an early stage of scientific development, there was a time when pseudo-science once prevailed. The examples of pseudo-science at this time include phrenology and eugenics. Phrenology is a pseudo-science that was popular in the 19th century Europe, and its central notion was that measuring the contour of the skull could predict one's mental traits. According to Steven Shapin, phrenology was associated with the rise of the bourgeoisie and was an attempt to justify by reverting human merit as a source of shame and power to individual traits. However, because of its deterministic view of humans' physical traits, phrenology can

be seen as a conception of racism or eugenics. Above all, phrenology does not make sense scientifically. Eugenics is a pseudo-science that has had significant side effects, from the Nazi Holocaust to the Soviet Union's ethnic cleansing and even the sterilization law in the United States. Eugenics spawned an ideology that there is superiority and inferiority among different races, or that inferior traits should be eradicated even among the same race, so that they would not be passed on to the future generations.

With the advances in science, the unscientific nature of phrenology and eugenics was confirmed, and the perception that certain races are superior to others was proved wrong. As a result, racism could be defined as outdated, which became an important weapon in socially excluding racism. Furthermore, it contributed to the elimination of discrimination against the disabled and the promotion of their rights and interests. Although deep-rooted racism still remains a problem in some countries, it is worth noting, at the least, that advances in science and technology have contributed to the mitigation of racial discrimination and conflicts.

3) The development of science and technology reduced religious conflicts.

The conflict between science and religion, which has persisted for over 300 years since Galileo muttered "And yet it moves", seems to come out as victory of science. In Europe, the proportion of nonreligious population is increasing every year that a post-religious society is on its way. With the increasing influx of Muslim population, who hold strong religious beliefs, the prospect that the largest religion in Europe will soon be Islam is highly likely to become true. Although controversial, it is somewhat true that science has been a threat to Christianity. It is no coincidence that there are many scientists among radical atheists such as British evolutionary scientist Clinton R. Dawkins or chemist Peter W. Atkins. As European society becomes post-religious, Protestant-Catholic conflict, which persisted over 400 years from the Reformation in the 16th century to Northern Ireland Conflict in the late 20th century, has lost its fuel. It is widely accepted that Northern Ireland Conflict has been settled with the Good Friday Agreement (Belfast Agreement) in 1998, but this was already after the beginning of a common crisis of the decrease in religious population, regardless of Protestant or Catholic.

Today, conflicts among religions or civilizations are occurring between the West and the Islamic world, but there is some dissent on whether such conflicts are truly religious or civilizational matters. Considering that there are fewer religious, civilizational conflicts with neighboring countries in the secularized Islamic countries like Turkey and Malaysia, it is reasonable to say that the basis of conflicts may be a difference in the scientific level, rather than the difference in religion.

The development of science and technology positively contributes not only at the macro level of religion and civilization but also at the micro level of cultural consumption. A prime example is Youtube, which transcends time and space today. The cultural contents consumed through Youtube cross national boundaries at our fingertips. Without Youtube, BTS's fandom would not have expanded throughout the world. Through video compression technology and USB flash drive, K-dramas have infiltrated the houses of North Korea more easily than ever. The North Korean leadership is using foreign words that are commonly used in South Korea, and North Korea's standard language, Pyongyang dialect, is becoming much more like Seoul dialect. Cultural integration expands consensus and narrows options for potential conflicts.

4) The development of science and technology prevents all-out war.

Although controversial, there is a deterrence theory that the concept of mutual assured destruction (MAD) prevents the outbreak of nuclear war. The conventional weapons also have the effect of preventing all-out war. The last cases of all-out war in the conventional sense are the Vietnam War and the Iran-Iraq War. The Gulf War, which was the major war in the second half of the 20th century, and the United States invasion of Afghanistan after 9-11 were completely asymmetrical wars in terms of science and technology for the United States owned the overwhelming high-tech weaponry. Modern defense technology enables constant surveillance of potential adversaries. Military satellites, high altitude reconnaissance aircrafts, broadband radars, wired and wireless surveillance, and cyber warfare provide real-time visibility and prediction of other countries' military movements. The predictable opponents cannot catch the right moment of provocation, and thus, armed conflicts that can be escalated are prevented in advance.

With the advancement of precision-guided munitions, it is now hard to find dictators

with temerity to carry out military provocations. With the press of a single button, the origin point of provocation under a concrete bunker tens of meters underground and hundreds of kilometers away can be blown. The carrier strike group, which had guaranteed an overwhelming advantage in conventional forces, inevitably changed its strategy with the emergence of anti-ship hypersonic cruise missiles. In modern society of the 21st century, the probability of an all-out war between great powers has been drastically reduced.

In this article, I have discussed the relationship between science, technology and peace. It is not to say that the development of science and technology enlightens the entire human race and leads onto the path of peace altogether. Instead, I content that as science and technology developed, the factors of traditional conflicts have declined and that the development of universal science and technology may bring about a balance of power and lead to a forced peace. However, as I have mentioned, there is a limitation of securing evidence that science and technology have contributed to the promotion of peace, since peace has more influence factors than science and technology. I hope this article will become a starting point of integrating the science and technology studies with the peace studies.

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The **IPUS HORIZON** is a venue that aims to offer new perspectives on the peace related research conducted in various departments and to provide in-depth discussions on the issue of sustaining peace not just on the Korean Peninsula but also at the global level. It explores the knowledge of the peace agenda in the fields of mankind, society, state and environment and provides peacebuilding discourses based on the reflection on conflicts and crises humanity faces today.

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