Technopolitics: How Technology Shapes Relations Among Nations

Mohan Malik, Ph.D.

Great power politics is very dynamic. But what are the dynamics of great power politics? What is the key driver of great power politics, especially in the 21st century? This paper contends that advances in science and technology (S&T) have long influenced the course of international politics. Technology, in fact, is one of the key determinants in shaping relations among nations, alongside wars and economic shifts. It remains the key tool for promoting economic development and national security**.** In the past, developments in technology gave us the industrial revolution that created the modern international system. Technologically advanced industrialized nations accumulated and exercised their vast economic and military powers in order to establish their supremacy over less advanced parts of the world, in effect creating a hierarchy among nations.

Historically speaking, tectonic shifts in global politics have occurred rapidly due to three factors: wars, economic shifts and technological developments. In 1935, with no armed forces to speak of and an economy in decline, the United States wanted to be left alone. However, only 10 years later, armed with nuclear weapons and flush with victory in World War II, an economically prosperous United States took over from Pax Britannica. By making war more destructive, technology has made war an unreliable means of conducting great power relations, thereby fostering co-operation among states. Twenty-two years ago in 1990, China was in the international doghouse post-Tiananmen massacre and India seemed to be at war with itself. Japan was then Number One in Asia. But long cycles of economic growth in China and India and stagnation in Japan have led to a tectonic shift in the global power structure and changed these countries' ranking and status in the pecking order. One of the key factors in the rise of China and India has been rapid technological adoption and advancement.

Information and communication technologies (ICT) in particular have cast a pervasive impact in the dynamics of international relations. According to Charles Weiss, the impact of ICT "may be classified as operating through one of four main mechanisms:

1 changing the architecture of the international system: its structure, its key organizing concepts and the relations among its actors;
2 changing the processes by which the international system operates, including diplomacy, war, administration, policy formation, commerce, trade, finance, communications, and the gathering of intelligence;

3 creating new issue areas, new constraints and trade-offs in the operational environment of foreign policy, a term which includes not only political constraints on international action, but also constraints imposed by the laws of natural and social science; and
4 providing a source of changed security perceptions, of information and transparency for the operation of the international system, and of new concepts and ideas for international relations theory."[1]

The Global Diffusion of Technology

The dynamics of globalization unleashed by technology is transforming relations amongst nations. Technological advances have emerged as the principal agents of social, economic and political change, drawing the world closer whilst also dividing it. The "revolution in dual-use technologies" for instance, is generating fundamental transformations both in the way wealth and power is created and wars are fought because technology diffusion is now virtually instantaneous and unstoppable. Unlike in the past, technology diffusion now takes place at its most advanced level. Commercial satellites, GPS readings, space-based imagery, weather data, and Internet data – they all have potential military applications in communications, navigation, intelligence and operation support. The "equalizing" feature of ICT has also lent non-state entities more power to initiate societal change and to address the broadest audience possible in virtual time, undermining in some cases the monopoly of the modern state to govern and rule. Using suicide bombers and improvised explosive devices as their technologies of choice, terrorist groups – considered non-state players in the international arena – have exposed the shortcomings of traditional war-fighting responses and created new vulnerabilities for states.

Developments in advanced technologies – such as the next generation microelectronics, nanotechnology, biotechnology, robotics and artificial intelligence – will upset existing balances of power and shape military capabilities for future conflicts. Forecasts indicate that S&T advancements will transform the battlefield in the decades ahead. By the year 2030, several states will acquire formidable power-projection military capabilities with weapons of increasing range, accuracy and destructiveness for the conduct of high-intensity conflict. Doctrines of flexible response for multiple missions based on high-technology weapons and a diversified, yet integrated, force structure will be the key principles of defense policies of major powers. The "front" will disappear as the whole country will become the battlefield. Since the front will no longer be the main battlefield, long-range force projection weaponry for deep strikes, like ballistic and cruise missiles and amphibious capabilities, will assume significance in the frontless wars of the future. No arms control agreement or non-proliferation regime or technology control mechanism can prevent the proliferation of the technological means of war.

But global technological diffusion will continue to be uneven, and will allow some nations who have the technological edge to gain strategic advantage over others. The changes in geopolitical systems of trade, offshore production by multinational corporations, and intellectual property protection, coupled with advances in ICT, have helped globalize research and development (R&D)

activities. While the United States, Japan and the countries in Western Europe have been the traditional focus of R&D, China and India have emerged as the new destinations for R&D, a trend that will enhance their ability to attain global scientific and technological leadership. China has the potential to leapfrog in cyber and space technologies and concepts. Chinese strategists have long called for a high-tech upgrade of its military to prepare to fight a future war in which software beats manpower.[2] As early as in1997, three members of the People's Liberation Army's (PLA) Academy of Electronic Technology wrote an essay in *China Computer World* that called upon China to abandon the "traditional concepts of war-making...which emphasized the destruction of hardware, attacking cities, seizing territory and inflicting casualties. Now, the struggle to control information is the focus of weapon systems and the countermeasures taken against these systems… Conducting warfare with computer viruses is more effective than using nuclear weapons."[3] The PLA has identified a number of "focus areas": modern command-and-control communications systems, cyber, space and long-range ballistic and cruise missiles for deep strikes, stealth platforms, and improved air defenses. Indeed, outer space, cyberspace and ocean beds are emerging as the new arenas of strategic competition. Countries that dominate in key technologies in these domains will have an edge over others. It is not a coincidence that a great power shift now under way coincides with the search and development of new weapons technologies of the future. Whichever country invents a new weapon system ("the assassin's mace" as the Chinese call it) would shift the overall balance of power (as nuclear weapons did in 1945) in its favor.

The New Great Game: "Techno-Resource Nationalism"

Every international order is based on an energy resource. Resource politics generates both competition and cooperation between nations. Great power contests are essentially struggles for resources. We moved from the Age of Sail to Coal and Steam, both of which were the basis of Pax Britannica. When the British ran out of steam, literally speaking, the U.S.-led order came into being, based on oil and nuclear energy. Is it a coincidence that the U.S. is seen as a declining power just when the world seems to be running out of oil?

Most wars of the 20th century were energy wars. Stating the obvious, much like humans, nations need energy to revitalize and re-energize in order to defend core interests. In this context, technology for rising powers such as China and India is central to any discussion of their resource base, certainly a key variable in their "comprehensive national power" strategies and politics. To understand the great power play under way in Asia of the early 21st century, strategists contend that we need to brush up our knowledge of the classic works on geopolitics by Halford Mackinder and Nicholas J. Spykman. The role of transportation technology, in particular, deserves special attention as it is changing the geopolitics of the Eurasian landmass. To illustrate, much like Britain and Russia before it, China is now employing modern transportation technology to re-draw the map of Eurasia via high-speed railways, highways and pipelines. Beijing is spending billions to create its alternative hub-and-spokes economic system whereby the various pipelines, railroads and highway transportation networks linking China with Central, Southwest and Southeast Asia will serve as the spokes or arteries that will bring in raw materials and energy resources while exporting Chinese

manufactured goods to those regions and beyond. One can argue that the two most important determinants of China's foreign policy today is oil and technology (specifically energy technology) – not Taiwan, not the U.S., or any other issue.

In the absence of a major scientific discovery or technological breakthrough, the *oilpolitik* will continue to shape power capabilities and culminate in the emergence of new coalitions and geopolitical alliances in the decades ahead. The energy competition is also heightening tensions over the ongoing territorial/maritime disputes, and shaping defense modernization plans and forging new military alliances. Within the next decade or so, the Arctic Ocean is likely to become another area of energy competition.

Not surprisingly, the foreign policies of major economies are being transformed as much by the energy imperative as by the technological imperative. We are seeing the rise of "petro-superpowers"– nations that wield disproportionate power in the international system by virtue of their superior energy reserves. A new energy architecture is emerging. New alliances between consumers and producers are emerging. Saudi Arabia is now looking for new partners in the East. Russia is using energy to stage a comeback on the world stage. We are witnessing a mad rush – a sort of treasure hunt – to gain control of energy resources by China, India and Japan, especially in those countries which are outside the control of major western companies for political reasons. The quest for resource technology is providing a new thrust to China, U.S., Russia and India's diplomacy. While pursuing a mercantilist foreign policy over oil, gas, and minerals, Beijing is also investing heavily in green energy technologies (renewable energy resources such as solar, wind and nuclear technologies) that could help China leapfrog over other major economies in the future.[4]

The creation or discovery of a new clean, cheap energy source could be a technological surprise that has the potential to usher in a new world order. For the first time in history, major economic powers, while still desperately searching for oil, seem serious about finding a substitute for oil. This quest for energy technology explains the mad rush to plant flags on the moon and on ocean beds. Indeed, the race is on for green energy. The new global order may well be based on a mix of solar, hydrogen, lithium and thorium. New energy resources and technologies have the potential to reshape major power relations and bury once and for all the talk of embargoes, containment and blockades. Imagine a scenario where we wake up one fine morning to the news that a real, cheap substitute for oil has been found and we don't need the Middle East as much we do today. What would that mean for geopolitical alliances? Hence, it is argued that "resource & techno-nationalism" lie at the root of the new Great Game.

Technology Determines Hierarchy in International Relations

There is a direct correlation between a country's place in the global hierarchy and S&T capabilities. Modern technology is central to the pursuit of national goals for all nations-big or small. However, the pace of technological change across continents and countries is never uniform. Early adoption of new technologies bestows advantages on newcomers. In a globalized world,

technology access and technology denial play key roles in determining the fate of nations. Nations compete either by raising themselves to higher levels of techno-economic performance or by keeping others down, technologically and economically. Technologically advanced nations also enjoy the power to set the norms and standards of behavior in international politics. Great powers, in particular, compete ferociously to maintain their top dog status through their edge in technology. Most high-tech developments are driven by the competitive national quest to maintain the technological superiority over others.[5] Military strategists, in particular, see superior technology as the key to remaining ahead of enemies and competitors. Technological advances invariably upset existing power balances and shape military capabilities for future conflicts. The restrictions on the transfer of high technology have long been a bone of contention in Washington's relations with both New Delhi and Beijing.

In the 21st century, China is determined to become globally competitive in technology innovation. Interestingly, the Chinese do not subscribe to the "Global Commons" perspective. They call cyber, space, environment and maritime domains as China's "strategic frontiers" where Beijing must have technological edge over others. Releasing the 2006-2020 Science and Technological Development Plan on January 9, 2006, former Chinese President Hu Jintao said: "By the end of 2020, China's science and technological innovation ability will be greatly improved…By that time, China will achieve more science and technological breakthroughs of great world influence, qualifying it to join the ranks of the world's most innovative countries."[6]

Both the current global S&T leader, the U.S. and rising India are also on the innovation offensive. In "A Strategy for American Innovation" in 2009, Barack Obama said: "The United States led the world's economies in the 20th century because we led the world in innovation. Today, the competition is keener; the challenge is tougher; and that is why innovation is more important than ever." His administration continues to provide support on a wide array of civilian and military technological platforms designed to keep the U.S. on the leading edge of S&T innovation. For his part, while announcing the creation of India's National Innovation Council in 2010, Indian Prime Minister Manmohan Singh stated that the Government of India has declared the next decade (2011-20) to be the "Decade of Innovation."[7] Though India has a long way to go, the institutional and policy foundations for sustained S&T innovation are taking shape. Geopolitical alliances are as much about technology as about shared interests and values. After Israel, India is now poised to become a global hub for high-tech R&D, especially defense R&D, mainly because major American and European defense manufacturers are more comfortable with India than China. And this has implications for great power alignments and Asian balance of power. Aspects of techno-nationalism are reflected in a range of trophy projects, including in efforts to set new technological standards and Chinese and Indian ambitions in space and the oceans.

China's R&D expenditure increased to 1.5 percent of GDP in 2010 from 1.1 percent in 2002, and should reach 2.5 percent by 2020. Its share of the world's total R&D expenditure grew to 12.3 percent in 2010 from 5.0 percent in 2002, placing it second only to the U.S., whose share remain steady at 34 to 35 percent. According to UNESCO, China now employs more people in science and technology R&D than any other country.[8] Innovation and idea generation remain strong in

Japan and South Korea and have been picking up in China and India due to improving education and a reverse diaspora brain gain. Reverse brain gain is seeing tens of thousands of skilled Chinese and Indian workers from the West returning home and fueling economic growth. This flood of Western-educated and skilled talent will boost their countries' economic competitiveness. From Beijing to Bangalore, from Seattle to Sao Paulo, new industries and innovations are flourishing. China and India produce five times as many engineers as the U.S. Some estimates show that 90 percent of engineers will hail from Asia by 2030. Nearly 25 percent of patent applications in the U.S. have foreign nationals as inventors or co-inventors.

For the time being, the U.S. leads in R&D worldwide with 35 percent of the total output. China comes in second with 16 percent, and Japan in third with 13 percent – but both are catching up fast. According to the Thomson Reuters National Science Indicators, Asia increased its global share of published science articles from 13 percent in the early 1980s to 30 percent in 2009. China is leading the way, having increased its share of articles to 11 percent in 2009 from just 0.4 percent in the early 1980s. Japan is next, accounting for 6.7 percent, followed by India with 3.4 percent. Studies show that in 15 years, China and India are expected to achieve near parity with the U.S. in two very different areas: scientific and human capital (India) and government receptivity to business innovation (China). China and India will narrow significantly – but not close – the gap in all remaining factors. The U.S. is expected to remain dominant in three areas: protection for intellectual property rights, business sophistication in maturing innovations and encouragement of creativity.

Many projections say China's and India's gross domestic product (GDP) could overtake that of the U.S. and Japan respectively by 2025. However, size alone may not matter as long as the U.S. and Japan retain their technological edge. The culture of creativity and entrepreneurship could give the U.S. and Japan the boost they need. Major economies recognize the critical importance of innovation – the application of new inventions and technologies to solve old problems, address new challenges and generate economic growth. When it comes to technological innovation, open societies seem to have an edge over closed societies as open minds generate innovative ideas. And innovation is the engine of economic growth. That is why it would be unwise to write off Japan. Japan could yet spring a technological surprise. Some Chinese economists calculate that within a decade or so India could come close to "spoiling Beijing's party of the century" by outpacing China in economic growth. From Beijing's perspective, India's economic rise coupled with the U.S.' S&T edge would prolong American hegemony in Asia, thereby hindering the establishment of a post-American Sino-centric hierarchical regional order in the Asia-Pacific. That is one reason for the deterioration in China's relations with India.[9]

Given their rapid pace of economic development and large domestic market size, China, India and other emerging economies have the potential to be the sources of new revolutionary technologies, e.g., the development of new clean water and energy sources, the next generation of Internet, power generation, and so on. Future technological breakthroughs will transform our world in a similar way as the Internet did, leading to a rebalancing of the global economy and a rebalancing of the power within it. In short, technologies of the future will once again determine the fate of nations. Technological innovations of the future could turn today's losers into tomorrow's winners.

Techno-economic competition will remain the most effective tool for perpetuating hegemony and for neutralizing or keeping a political and military adversary at bay.[10]

To sum up: as in the past, so in the future, technology will play a role greater than any other factor in shaping relations among nations. Geopolitical alliances of the future will continue to be underpinned by the varying levels of technological development among nations. In a globalized world economy, countries will take advantage of their comparative technological advantage over others. Access to technology (or the lack of it) will determine a country's place on the pecking order in the regional and global hierarchy. Let me end by paraphrasing the famous naval theorist Alfred Thayer Mahan: in a globalized world economy, whoever has the technological edge will dominate the world. In the 21st century, the destiny of the world would be decided in the S&T field. Short of wars, major power rivalries and alliances will revolve around technology, resources and trade. Technology could help moderate great power competition and hopefully, prevent wars as nuclear weapons technology did after the Second World War. Advancements in technology will not only change the way we live and fight, but also the way our world is organized. So a great deal of thought needs to be given not just to how technology will change battlefields of the future, but to geopolitical shifts and marketplace dynamics as well. At every level of inter-state interaction, technology remains the fundamental explanatory variable in understanding the international system.

Notes

1. Charles Weiss, "Science, Technology and International Relations," *Technology in Society* 27, no. 3 (2005): 295-313.

2. A book published by two Chinese air force colonels in the 1990s listed 24 formulations in which China could use tactics outside the conventional handbook of war to infiltrate and weaken an opposing country. Political and economic chaos could be created by hacking into or destroying computer systems with viruses, with terrorist acts or through biochemical warfare, the PLA colonels said. See Lynne O'Donnell, "China gears army for cyber-war," *The Australian*, November 10, 1999, 11.

3. Quoted in *China: Will It Become the West's Next Great Adversary?,* Publication of the Center for Security Policy, No. 98-D 21 Decision Brief, February 4, 1998; See also Ivo Dawnay, "Beijing Launches Computer Virus War on the West," *The Age*, June 16, 1997, A8.

4. Commentary, "China's Global Arrangement and Diplomatic Focus for Its Strategic Resources," *Chinese Cadres Tribune,* July 30, 2011, trans. *http://chinascope.org/main/content/view/3776/92/.*

5. Amitav Mallik, *Technology and Security in the 21st Century* (SIPRI: Oxford University Press, 2004), ix-x.

6. Quoted in James Wilsdon and James Keeley, "China: The next science superpower?," *http://www.naider.com/upload/82_China_Final.pdf.*

7. Amb. Karl F. Inderfurth and Persis Khambatta, "A U.S.-India Innovation Partnership," *U.S.-India Insight* 1, no. 5 (2011).

8. Anil K. Gupta and Haiyan Wang, "China as an Innovation Center? Not So Fast," *Wall Street Journal*, July 28, 2011. See also Robert J. Herbold, "China vs. America: Which Is the Developing Country?," *Wall Street Journal*, July 9, 2011.

9. For details, see Mohan Malik, *China and India: Great Power Rivals* (Boulder and London: Lynne Rienner Publishers/First Forum Press, 2011).

10. Mallik, *Technology and Security in the 21st Century*, 102.