



Global Technology Revolution 2020

Technology Trends and Cross-Country Variation

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The world is in the midst of a multidisciplinary technology revolution that shows no sign of abating in the near- to mid-term future. By 2020, this revolution could bring important changes in economic development, health, environmental quality, and military power.

While the technology revolution is extensive, it will play out differently around the globe. That core realization is now quantitatively supported by a RAND Corporation study that has sought to elucidate what factors will influence the potential of the technology revolution in different countries and what general inferences might be drawn about the future of that revolution. The study was sponsored by the National Intelligence Council as an input to its broader report, *Mapping the Global Future*.

The RAND research team identified 56 illustrative technology applications that might possibly be developed and implemented by 2020. Of these, the researchers selected for further analysis 16 applications scoring highest in a net assessment combining technical feasibility on a commercial basis, potential marketability, and, most important, the number of societal sectors influenced (see the table).

To assess the implications of these technology developments, the research team focused on 29 representative countries selected for variation in size, region of the world, and sociopolitical conditions. By analyzing the capacity to acquire technology applications together with ten social, economic, and cultural factors that might act as implementation drivers and barriers, the project team arrayed the illustrative countries according to their capacity to both acquire and implement the 16 illustrative applications (see the figure). The figure shows, along the horizontal axis, how many of the ten factors (in percentage terms) act as barriers to technology implementation in each country. Along the vertical axis, it shows the number of factors acting as drivers (also in percentage terms)

Key findings:

- Technology development will continue at a rapid pace over the next 15 years.
- The global technology revolution will play out differently across nations.
- Technologically lagging countries face challenges in institutional, human, and physical capacities.
- Advanced countries will stay ahead only if laws, public opinion, and other social factors do not become impediments.
- Some technology applications will trigger strong reactions over religious, environmental, or social concerns.
- Public policy issues will need to be debated in an environment that seeks to resolve conflicts.

multiplied by an index of the capacity to acquire the technology applications. This figure helps highlight a number of key trends and relationships that emerged from the RAND study:

- The technological preeminence of the scientifically advanced countries in North America, Western Europe, and East Asia.
- The emergence of China and India as rising technological powers, with the scientifically proficient countries of Eastern Europe, as represented by Poland, not far behind.
- The relative slippage of Russia as a technological powerhouse.
- The variation in technological capability among the scientifically developing countries of Southeast Asia and Latin America.
- The large technological gap between the scientifically developing countries of Latin America, as well as Turkey and South Africa, and rising technological powers China and India.
- The enormous technological gap between the scientifically lagging countries of Africa, the

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Sixteen Illustrative Technology Applications Scoring Highest in the RAND Net Assessment

Cheap solar energy
Rural wireless communications
Genetically modified crops
Filters and catalysts for water purification
Cheap housing for adaptable shelter and energy
Rapid assays to detect specific biological substances
Green manufacturing
Ubiquitous radio-frequency identification tagging of products and people
Hybrid vehicles
Drug delivery targeted to specific tumors or pathogens
Improved diagnostic and surgical methods
Quantum-mechanical cryptography for secure information transfer
Communication devices for ubiquitous information access
Pervasive sensors
Tissue engineering
Computers embedded in clothing or other wearable items

Middle East, and Oceania and the advanced nations of North America, Western Europe, and Asia.

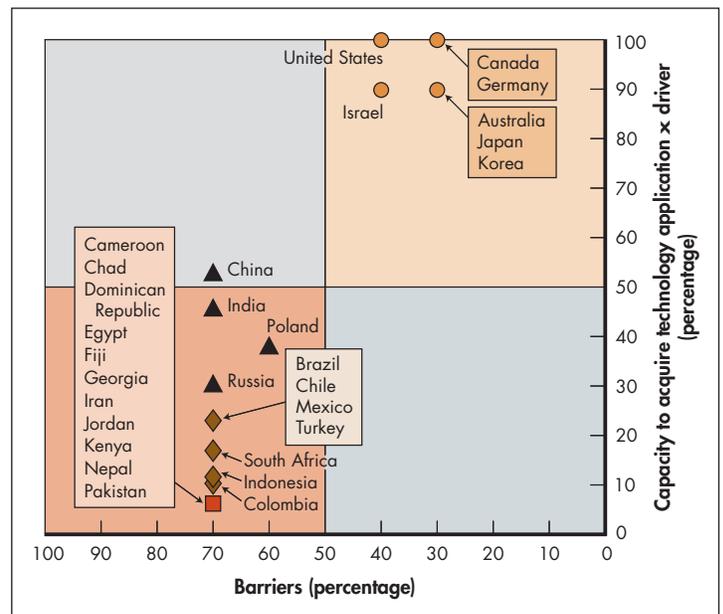
- The gap that must be filled before the lagging nations can reach the level of proficiency.

Finally, the researchers recognized that a country having the ability to acquire and implement a technology application would not necessarily do so, unless it was motivated by national or market needs.

On the basis of these and other analyses, the RAND researchers drew the following conclusions:

- **Accelerated technology development will continue.** There is no indication that the rapid pace of technology development will slow in the next 15 years, nor will the trend toward the increasingly integrated nature of technology applications reverse. Most of the 16 illustrative technology applications listed in the table draw from multiple technologies, e.g., biotechnology, nanotechnology, materials and information technologies. The combined effect of further technology development and implementation will be significant, changing lives around the globe.
- **Countries will benefit in considerably different ways.** Because of variations in science and technology (S&T) capacities and in the institutional, human, and physical capacities relevant to implementing technology applications, the global technology revolution will play out differently across nations.
- **Action is required to maintain a high level of S&T capacity.** If the advanced countries are to stay ahead in their capacity

The Capacity of Selected Countries to Implement the Sixteen Illustrative Technology Applications



to implement technology applications, they will need to make continuing efforts to ensure that laws, public opinion, investment in R&D, and education and literacy are drivers for, and not barriers to, technology implementation.

- **Countries that lack capacity will need to build it.** The challenge faced by scientifically lagging countries and developing countries is not primarily about technology, or even S&T capacity. It is the lack of institutional, human, and physical capacity, including effective governance. Less-developed countries that hope to benefit from technology applications will have to improve their performance in economic growth, social equity, health and the environment, and public safety and security.
- **Certain technology applications will spark heated public debate.** Several of the illustrative applications will trigger strong reactions and opinions over religious, environmental, or social concerns (including privacy). These reactions could differ dramatically across countries and thus contribute to the international variation in technology implementation.
- **Public consideration can head off problems and maximize benefits.** Public policy issues will need to be debated in an environment that seeks to resolve conflicts. Such public debates, in addition to being based on sound data, will need to be inclusive and sensitive to the range of traditions, values, and cultures within a society. ■

This research brief describes work done for the RAND National Security Research Division documented in *The Global Technology Revolution 2020, Executive Summary: Bio/Nano/Materials/Information Trends, Drivers, Barriers, and Social Implications*, Richard Silberglitt, Philip S. Antón, David R. Howell, and Anny Wong, MG-475-NIC, 2006, 53 pages, \$25, ISBN: 0-8330-3910-5, available at <http://www.rand.org/pubs/monographs/MG475/>, and *The Global Technology Revolution 2020, In-Depth Analyses: Bio/Nano/Materials/Information Trends, Drivers, Barriers, and Social Implications*, Richard Silberglitt, Philip S. Antón, David R. Howell, and Anny Wong, TR-303-NIC, 2006, 314 pages, ISBN: 0-8330-3975-X, available at http://www.rand.org/pubs/technical_reports/TR303/. This product is part of the RAND Corporation research brief series. RAND research briefs present policy-oriented summaries of individual published, peer-reviewed documents or of a body of published work. The RAND Corporation is a nonprofit research organization providing objective analysis and effective solutions that address the challenges facing the public and private sectors around the world. RAND's publications do not necessarily reflect the opinions of its research clients and sponsors. RAND® is a registered trademark.



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