INTERNATIONAL R&D OVERVIEW

Global and international research and development are, of course, synonymous. More than 60 countries in the world annually perform more than a billion dollars each of R&D and their numbers are growing. The number of researchers—scientists and engineers—has expanded dramatically over the past 20 years in most countries and, except for economically distressed regions, their R&D expenditures have similarly expanded, especially over the past five years. R&D investments have recovered since the global Great Recession of 2008-2009, and most countries find themselves in fiercely competitive positions for creating new technologies, processes and products to grow their economies. The headlines are filled every day with the announcements of new scientific breakthroughs, discoveries and developments. The countries where these events occur are no longer of any significance, importance or even newsworthiness—they can occur anywhere since information and technology is now distributed globally. Whether R&D managers like it or not, most global scientific and technological capabilities are now shared around the world.

This, of course, is not to say that R&D capabilities, knowledge and science and technology (S&T) wealth are equal throughout the world. Many emerging countries are playing S&T "catch-up" with the established countries and many regions outspending (on a percentage basis) the established S&T leaders to increase their competitive S&T positions. China and other countries are on fast tracks to build basic science infrastructures that equal or even exceed those of the U.S. and Europe. For example, while many countries used to launch their in-house developed space monitoring or communication satellites on U.S., European or Russian space launch systems, many now build their own launch vehicles, increasing again their basic technology capabilities. And while U.S. R&D has a strong standing in many areas as noted on the attached table, it doesn't always dominate specific technologies. Other countries have nearly as strong technological capabilities in some areas. For example, Germany and Japan are equally strong in automotive, environmental and instrumentation areas.

Academic R&D capabilities are still dominated by U.S. and European institutions and, as noted in the academic R&D section in this report, that advantage may even be growing due to a number of innovative and established methodologies. About one in three universities which are ranked in the top 500 universities in the world are located in the U.S. The academic capabilities of non-U.S. and non-European countries are increasing, but to jump start their capabilities, the emerging countries often create educational partnerships with the strong, established educational institutions, which benefits both parties.

U.S. researchers have dominated the Nobel Prize Awards, both

Technology Sector Leaders

	U.S.	China	France	Germany	Japan	Russia	Korea	UK	Other
Advanced Materials	59%	15%	1%	12%	7%	1%	2%	2%	2%
Agriculture/Food	68%	10%	3%	5%	2%	1%	1%	1%	10%
Automotive	22%	6%	1%	29%	32%	0%	8%	0%	2%
Commercial Aerospace	62%	3%	10%	6%	1%	13%	1%	2%	2%
Communications	57%	13%	0%	2%	13%	0%	4%	4%	6%
Energy	49%	10%	3%	20%	7%	1%	1%	1%	8%
Environmental	37%	1%	6%	26%	8%	1%	2%	6%	12%
Instrumentation	41%	9%	1%	14%	22%	1%	9%	1%	2%
Life Science/Healthcare	43%	2%	7%	18%	7%	0%	2%	9%	12%
Military/Defense	78%	6%	1%	1%	0%	11%	1%	1%	2%
Pharmaceutical/Biotech	56%	4%	3%	16%	5%	1%	1%	7%	8%

The U.S. continues to dominate most of the technological sectors, with the exception of automotive where it shares the lead with Germany and Japan. Electric automotive research is being driven by several U.S. leaders including Tesla and the U.S. Dept. of Energy which could lead to a resurgence in this area by the U.S.