

FOREWORD

I grew up in the United States in the years following the Second World War, when a "Made in Japan" label on a product was synonymous with "cheap", "flimsy", and "easily broken". Products made in China, Korea, Singapore, or other Asian countries were — at least in my childhood and youthful experience — somewhere between scarce and non-existent. "Quality" was not a word that immediately sprang to mind in connection with Asian products. Neither was "innovation". The general impression of these products among Americans (at least Americans of my generation) in those early postwar days was that they were inexpensive knock-offs of American goods made with inferior materials and workmanship.

It is hardly necessary to point out today how much things have changed. Asia has become a powerhouse in science and innovation. Led by China and India, Asian nations are not just producing superb, innovative products, they are conducting frontier research and producing far more engineers and highly trained technical workers than the United States or Europe. The GDPs of these nations are expanding at a record pace, and their research and development expenditures, and hence their R&D/GDP ratios, are growing even faster. And, in even greater contrast to the way things were five decades ago, Asia has developed a solid reputation for quality and innovation. Most visible to consumers worldwide are Japanese and Korean automobiles and electronics and Chinese products of all kinds. But it does not end there. Asian nations are leading the way in creating

the technologies that promise to define the 21st century, including renewable — especially solar — energy generation.

These developments are not accidental. They are the result of strategic decisions made by the governments of these nations to invest in R&D and to create networks of science and technology institutions emulating and improving on the best features of the American system — entrepreneurial research universities linked to high-tech industrial firms and well-supported government research laboratories and agencies. For a notable example of the physical and institutional expression of this strategy, one needs look no farther than Singapore's "opolis" twins, its well-known Biopolis and its more recently established Fusionopolis.

This most interesting and highly original book by Professor Seeram Ramakrishna and Daniel Joo-Then Ng of the National University of Singapore presents a vivid picture of the rise of Asian science and technology. With a wealth of statistics, charts, graphs, and illustrations, these insiders on the Asian innovation scene make a strong case for their thesis that, as the book's title states, the face of global innovation is changing and that it is indeed moving in the direction of Asia.

This is an optimistic book. Implicit in its discussion of Asia, a huge continent comprising many nations, and the authors' many comparisons of Asia versus the United States is the assumption that ancient and modern rivalries and modern geopolitical factors and conflicts internal to Asia will decline in importance relative to the shared goals of technology-based economic growth. Similarly, there is the expectation, or at least the hope, that the new face of innovation will allow the Asian nations to overcome the vast areas of poverty and backwardness that dominate large parts of their rural landscapes. In fact, the authors suggest that the innovation motivated by the need to overcome these problems will strengthen their hand in global commerce. These are laudable hopes, but they are hopes and their realization is far from certain.

As a lifelong technological optimist myself, I share the authors' upbeat view of the future. At the same time, I am compelled to ask from the perspective of an American what the shifts they describe might mean for the United States and other western nations. I can see at least two complementary implications. One is the recognition by United States policy-makers of increased global competition. This has already had an impact. Impelled by the widely-read 2007 report of the United States National Academies, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (conceived in response to the perception of growing competition from Asia), United States policymakers came together in a rare display of bipartisan support to pass the "America COMPETES Act", which authorizes substantial increases in federal government funding for competitiveness-related R&D as well as major investments in science, technology, engineering, and mathematics education. Although Congress did not fund these programs initially, they have begun to take off with money from the Obama Administration's 2009 stimulus program.

The second implication is that of mutual benefit arising from the worldwide expansion of scientific and technological knowledge. Despite the ill-considered efforts of some governments, science does not stop at national borders or continental margins. This is especially true with 21st-century communication and transportation technologies. As scientific capabilities in China, India, and other Asian nations have been growing, new opportunities for cooperation have also been on the rise. Asians (like other non-United States citizens) who come to the United States to study or do research often continue working with colleagues or former mentors in the United States long after they return to their native countries. The results can be seen in the rapidly increasing proportion of scientific publications with international co-authorship appearing in the pages of *Science*,

Nature, and other prestigious scientific journals. The whole in these cases and in international scientific collaboration overall is, as experience has shown, greater than the sums of individual parts.

Ramakrishna and Ng end this volume with a provocative and idealistic proposal: they call for the establishment of a Global Research Foundation to support collaborative research on pressing global problems. The value of such a body should be obvious to anyone who has given even a modest thought to the multiple crises that face humankind and the role of science and technology in their resolution. The political difficulties that would confront those with the courage to try and implement the idea, however, should be just as obvious. It would be convincing evidence that the face of innovation has truly changed if the initiative for such an enterprise were to be taken by Asian nations.

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