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# Technological Development

*The Historical Experience*

Raymond Vernon

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## The Historical Experience

Raymond Vernon

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### **Abstract**

During the past few decades a considerable number of developing countries have managed to chalk up impressive records of social and economic growth. In some cases rich endowments of raw materials have helped in the process. For the most part, however, success has depended on the capacity of the people in the developing country to absorb and apply the technologies that the more advanced countries had already created and put in place. Scholars have long realized that a nation's capacity to absorb and apply foreign technology is a critical factor in its growth, and they have undertaken many studies aimed at increasing an understanding of that process. This volume attempts to set down the principal lessons that these studies suggest.

The first chapter draws its lessons from history. It explores the reasons for the unheralded and unanticipated emergence of Great Britain in the early nineteenth century as the world's industrial leader, and it reviews the factors that allowed the United States, Germany, Russia, and Japan to challenge that leadership in later decades. The lessons that emerge appear just as relevant for developing countries today as they were a century ago.

The second chapter attempts to extract from a large, diverse literature the lessons to be learned from developing countries' experiences since the end of World War II in the adaptation and application of existing technologies.

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## Introduction

During the past few decades, a considerable number of developing countries have managed to chalk up impressive records of social and economic growth. In some cases, rich endowments of raw materials have helped in the process. For the most part, however, success has depended on the capacity of the people in the developing country to absorb and apply the technologies that the more advanced countries had already created and put in place. Scholars have long realized that a nation's capacity to absorb and apply foreign technology is a critical factor in its growth. They have undertaken many studies aimed at increasing an understanding of that process. The two essays that follow try to set down the principal lessons that these studies suggest.

The first essay draws its lessons from history. It explores the reasons for the unheralded and unanticipated emergence of Great Britain in the early 19th century as the world's industrial leader, and it reviews factors that allowed the United States, Germany, Russia, and Japan to challenge that leadership in the following century. The lessons that emerge appear just as relevant for developing countries today as they were a century ago.

The second essay attempts to extract from a large, diverse literature the lessons to be learned from developing countries' experiences since the end of World War II in the adaptation and application of existing technologies.

Despite the vast changes in governmental and business institutions between the 19th and 20th centuries and despite the great disparity in the research materials available for the two periods, the two essays suggest some common lessons. The most important of these lessons is that government policies matter. They matter in the sense that ill-chosen policies can inhibit or prevent the adaptation and application of existing technologies, a point on which practically all would readily agree. But they also matter in the sense that well-chosen policies can facilitate such adaptation and application; a conclusion from which some will likely demur.

If my interpretation is right, Great Britain's early lead in the 19th century was largely serendipitous, the consequence of policies aimed at other objectives. In its desire to deny the throne the arbitrary rights of monopoly and seizure that were typically exercised by the monarchs in France, Russia, Spain and other countries of the time, the British Parliament had earlier reduced one of the major risks that otherwise faced any incipient industrialist of that early era: the threat that the government would arbitrarily introduce levies on profit-earning properties. British innovators also benefited from the relative weakness of guilds in Great Britain. By holding the powers of the guilds within limits, the British government protected innovative industrialists from some of the stifling discipline that guilds elsewhere in Europe commonly imposed upon their members. In addition, other market restraints also were relatively weak in the British Isles. By incorporating Scotland, Wales, and Ireland with England in a common, readily accessible market, the British avoided impediments of the kind imposed by regional tolls in France, by princeling states in Germany and Italy, and by vast frozen distances in Russia. In brief, the absence of restraints that appeared to differentiate British

industrialists (and later, American industrialists) from their continental competitors.

The policies of Germany, Japan, and Russia's policies toward the close of the 19th century suggest the less obvious conclusion, that governmental policies can also facilitate the application of industrial technologies. In all three cases, national governments at times aggressively supported entrepreneurs' efforts to apply existing technologies on their soil. Some of the support was diffuse and indirect, such as the liberal financing of technical education. Some was immediate and direct, such as providing subsidies for selected industries and projects. Great Britain's policies were far more passive in the latter part of the 19th century, and the prevailing historical judgment is that this difference in policies accounted in part for the relative decline of Great Britain during that period.

Studies during the past 40 years shed light on another facet of the process of absorbing and applying technology in developing countries. Although governments' policies may create an environment that impedes or encourages the process, governmental policies alone are not sufficient to assure effective transfer. The roles of managers and technicians in the country are critical in determining the outcome. Technology cannot be effectively transferred and diffused across international borders if managers and technicians receive it as if it were a black box. Those who receive the technology must be able to understand its structure and adapt the knowledge to local conditions. The propensity of managers and technicians in a developing country to do so depends not only on the national environment in which they operate, but also on their personal background and training, and on the incentives and penalties that operate in the firm's environment.

These familiar lessons, along with others summarized in the essays that follow, have wide ramifications for the policies in developing countries. They are relevant, for example, in shaping the characteristics of national education, establishing governments' relations with foreign direct investors, and applying national taxes and subsidies to industrial development. They represent a legacy of experience from which developing countries can profit.

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## Lessons from History

Economists and politicians in almost all countries agree that a nation's technological capability is important and affects its international position in various ways. Technology is important partly because of its role in national defense, but also because those who are first to develop and apply technology can often capture large oligopoly rents, as in the case of the U.S. aircraft industry and the Japanese video cassette recorder industry. The drive to be first is also motivated by factors that economists would categorize as irrational. For example, the inordinate pleasure that Americans derived in 1986 from Voyagers II's pioneering encounter with the moons of Uranus is not easily explained in economic or military terms; neither is the Russian's gratification over their successful encounter with Halley's comet, nor France's compelling urge to the first in supersonic commercial aircraft and nuclear power technology.

In the course of history, countries have advanced their technological capabilities through a number of different channels. As a rule, however, one could usually distinguish two distinct processes in the course of advancement. One has been the absorption and diffusion of technological innovations already being used in the country. Another has been the adaptation and improvement of those existing technologies. The propensity of the enterprises in any country to engage in such activities has depended on some rather obvious factors, including the training of their entrepreneurs, managers, and technicians, their opportunities for scanning the technological environment at home and abroad, their capacity for financing the costs and accepting the risks associated with technological change in their incentives for assuming those costs and risks.<sup>1</sup> In turn, national institutions and national values rooted deep in the history of each country have had a vast influence on these factors.

Whatever the reasons most countries strive to increase their technological capacity. However, the means by which governments promote that capacity vary greatly. To some extent, these differences in the role of government reflect the existing level of industrial development of the country concerned, but a comparison of countries at roughly equivalent levels of development, for example, Great Britain and France, or Argentina and the Republic of Korea, suggests the existence of other factors that are tied to the nation's history and influence its values and institutions.

History played a particularly strong role in the race among European powers for technological leadership during the 19th century. Existing values and institutions were critical in Great Britain's rise and fall as the technological leader. The lessons from that distant era to a remarkable extent prove applicable today.

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1. A rich literature exists on the factors affecting the diffusion of technological innovations. For a summary, together with a useful bibliography, see Christopher Freeman, *The Economics of Industrial Innovation*, 2nd ed. (Cambridge, MA: MIT Press, 1982), esp. pp. 207-248.

