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Using resources in R&D policy planning: Brazil, the Amazon and biotechnology

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Abstract

Brazil's research and development (R&D) policies are examined in light of changes in economic direction especially as it pertains to competition. In a competitive environment, regions should develop industrial applications and expertise in areas that coincide with their resources. These could be human resources but could, as in the focus of this paper, be useful resources that differentiate the region from others in the world. This differentiation provides an advantage to the region. Brazil and its Amazon region has the large majority of the world's rare genes. In biotechnology, genes are "green gold," and Brazil is slowly developing a biotechnology industry and beginning to tap into the Brazilian Amazon region's economic biotech potential. This region has enormous potential for the development of biotech-related technologies and products. This paper discusses the relationship between resources and an R&D strategy using as an example the recent developments in biotechnology research in Brazil and the role of the Amazon region in the development of a Brazilian biotechnology industry. It recommends a number of policy initiatives that will enhance Brazil's focus on biotechnology.

1. Brazil's R&D policies

The economic principles that guided Brazil's past policies placed a premium on protecting the Brazilian market from foreign competition. The interventionist hand of the Brazilian State made research

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and development unimportant for companies operating in the protected economic environment [1–3]. In addition, most R&D efforts were championed by the state; very few initiatives were controlled by the private sector. Several R&D efforts, like the creation of a Brazilian aircraft manufacturer, Embraer, were technological initiatives championed by the Brazilian government [4–6]. Thus, a tradition of strong reliance on the Brazilian government for R&D efforts was created [7–9]. This state-led R&D paradigm offers an interesting contrast to R&D paradigms developed in Asia, Europe, and the United States, where the private sector plays the leading role in R&D efforts [10].

In the early 1990s, a new economic model was established in Brazil. The Brazilian market was opened to foreign competition, placing more emphasis on technological innovation, quality, and competitive pricing. The Brazilian private sector was forced to rethink strategies and boost efforts to innovate and build competitive advantages. It was in this new economic scenario that Brazilian biotechnology efforts started to take shape [11].

Brazil's inward looking growth strategy has had substantial impact on R&D efforts. In the 1990s, Brazil invested less on R&D than many smaller Latin American economies and far less than countries such as the United Sttaes. As shown in Fig. 1, the United States invested 2.5% of its GDP in R&D efforts, about US$150 billion. Brazil, in the same period, invested 0.4% or US$1.95 billion/year on R&D efforts. Another emerging economy, South Korea, shows much higher ratios of approximately 2.5% [12].

Brazil is responsible for only 0.8% of the world's scientific knowledge [13]. This relatively low share has a number of dimensions. First, the number of scientists and engineers per one million people is an important dimension of the R&D picture. In Brazil, this number is around 165, compared to 5677 for Japan. Second, the number of researchers has an important impact on the country's brain pool innovation potential. By the late 1990s, the Brazilian scientific community was comprised of 30,000 researchers, 20 times less than the U.S. average [14]. Third, most of the R&D efforts are state sponsored, therefore, less sensitive to market-driven forces. In Brazil, the state accounts for about 80% of R&D investments. In Japan, the private sector accounts for about 77% of R&D efforts, and the state sector for only 23%. Fourth, the percentage of PhDs in a scientific field in Brazil that work for the private sector is small. For example, 50% of all PhDs in physics in the United States work in the private sector compared with 2% in Brazil [13]. Fifth, the Brazilian academic environment has paid

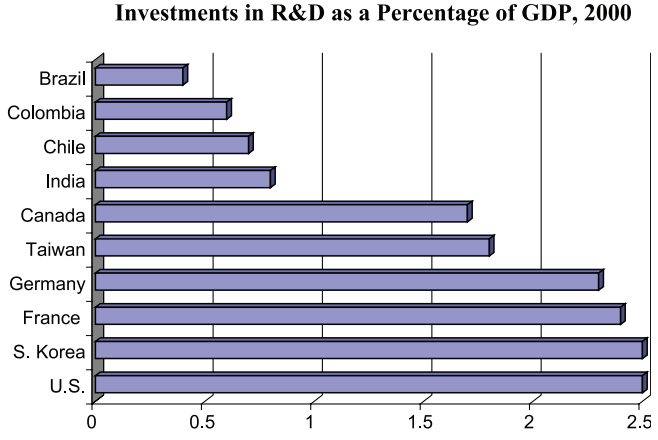

Fig. 1. Investments in R&D as a percentage of GDP, 2000. Source: Ref. [12].