

## **The Simple Economics of Basic Scientific Research:** The Journal of Political Economy (1959)

**The Question:** The public and non-profit sectors provide much of the funding for basic research around the world. Economic theory suggests that new scientific knowledge is under-provided by a private market because firms and individuals cannot capture the full social value of their discoveries. This seminal paper discusses a framework for why the government should participate in basic research funding. Why are private business profits not enough to draw resources toward basic research at the socially desirable level? If firms will not produce scientific research on their own, why should the government or non-profits subsidize the creation of scientific knowledge?

**The Lessons:** This paper proposes three key reasons that private firms do not spend enough on basic research. 1) Basic research is a public good. Once knowledge has been produced and shared with the world, the firm cannot capture all of the economic value of the future uses of that idea. Since the social benefits of research are larger than the private benefits, the competitive market will create less basic research than is optimal for society. 2) The direction of basic research is uncertain. Scientific inquiry is usually very open-ended. As scientists propose hypotheses and collect data, they may be led to new discoveries that are far distant from the original goals they had set out with. But firms have very specific goals for commercial applications, and the uncertainty of the eventual result of the research discourages them from participating. 3) Research is costly and has long time horizons. Firms often have very short-term profit motives, but research is expensive and applications ready for commercialization may not arise for many years. For these reasons, the government and non-profit universities have a role in subsidizing basic knowledge creation to raise expenditures on basic research to their socially optimal level.

**The Evidence:** The authors provide a number of case studies to illustrate the challenges of basic research in a private industry setting. Basic research is often fundamental for future applied innovations. Marconi probably never would have developed the radio if not for the fundamental work of Maxwell and Hertz, who in turn elaborated on the theories of Faraday from many decades earlier. Academic researchers are often better at efficiently redirecting resources toward the most promising projects. Louis Pasteur invented inoculation by accident after studying cholera in chickens. George Harrison Shull invented hybrid corn not intentionally, but as a byproduct of his research into fundamental questions in genetics. Often, only companies with a very broad base of technologies will fund basic research. For example, researchers at Eastman Kodak were researching chemicals needed for color photography and happened upon the discovery of Vitamin E, which led Kodak to enter the pharmaceutical industry. A system of open-ended basic research in the non-profit sector (funded by the government) is an efficient way to produce the fundamental knowledge needed for applied innovations in private industry. More evidence is needed to understand the *optimal* level of scientific funding, since the social costs and benefits of research are difficult to estimate.