Community Economic Development

Innovation and Economic Performance: Research and Development

Economists and business leaders agree, the creation of new ideas, processes and products, coupled with the ability to bring these to market, is the engine of economic growth and development. Sometimes these innovations are stumbled upon, but many are the result of purposeful investments in research and development (R&D). If R&D is vital to innovation, which in turn is vital to economic growth and development, it is important to have a basic understanding of what we mean by research and development.

A standard definition could be expressed as "work directed toward the innovation, introduction, and improvement of products and processes" or "the investigative activities a business conducts to improve existing products and procedures or to lead to the development of new products and procedures". Within a business profit maximizing context "research" hinges on the development of new ideas, processes and products and "development" moves those new ideas, processes and products into the market.

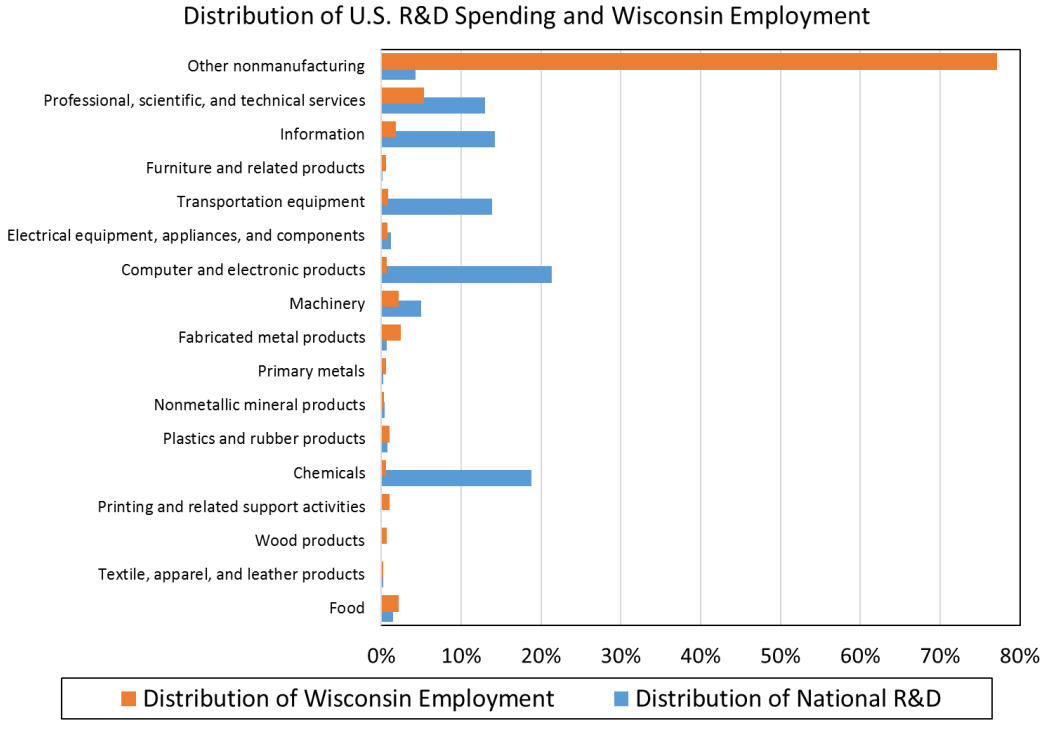
Many new things that flow from research turn out to be unsuitable for the market. For example, costs to the consumer may be unreasonable or the improvements over existing products already in the market are not sufficient to justify the costs. For example, in 1943 when computers where just becoming realized, Thomas Watson, president of IBM, infamously stated the "I think there is a world market for maybe five computers." At the time Mr. Watson might have been correct, computers were bulky and expensive with limited use. Any firm attempting to bring those early computers to market would have likely failed. But further research and development has brought us powerful computers that can be held in one's hand and have revolutionized our economy and way of life.

The nature of research is composed of two parts: basic and applied. Basic research is systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena without specific applications towards processes or products in mind. Applied research is a form of systematic inquiry involving the practical application of science. It accesses and uses some part of the research communities' accumulated theories, knowledge, methods, and techniques, for a specific, market driven purpose. Consider, for example, the development of stem cells. Original work on stem cells can be traced back to German researchers in 1860s who were trying to understand how eggs became fertilized. In the 1950s the work centered on trying to understand why cells mutated into cancerous cells. In the 1980s and 1990s, scientists asked if they could develop a "blank cell" or "stem cell" that could be turned into any type of cell (e.g., muscle cell, skin cell, etc.). In 1998, it was University of Wisconsin – Madison scientists James Thomson and Jeffrey Jones that uncovered methods to create human stem cells. All of these questions were being asked out of scientific curiosity. Why do cells turn into different types of cells and can we mimic that process in the laboratory? This is basic research. The difficulty is that the risk and uncertainty associated with this type of research is too great for most firms to invest. The uncertainty whether a profitable product can be brought to market is just too high. The question then, who is to finance this basic research? If businesses find it too risky and uncertain, the responsibility falls to the public sector.

Applied research takes the insights from basic research and explores if there are any marketable products or processes that can be further developed. For example, can we turn a blank stem cell into a heart cell in a consistent and stable manner? Can we take information from a heart patient and customize cells to help replace damaged heart cells? If we can, does it work to improve the health of the patient? These are all applied research questions. If the answer to these questions is yes, then the question turns to development of the process; how can we take this new technology to market? Is it cost effective? Are there cheaper alternative treatments that have equally positive outcomes? Answers to these questions determine if the process (product) is marketable. There is a clear progression from basic to applied research to development. Here businesses have a strong profit incentive to invest in applied research, but more importantly development.

Here we have two key players in financing research and development: the public sector must actively invest in basic research while the private sector invests in applied research and development. If we look at the distribution of all R&D investments in 2013, only 4% flowed to basic research, 16% to applied research and 80% to development. The sources of funding for R&D are different from who conducts the actual research. The federal government accounts for 27% of the money being spent on R&D but performs only 11% of research. Universities and colleges account for only 3% of the sources of R&D money, but accounts for 14% of the actual work, measured by expenditures. In essence, the federal government is providing significant grants and contracts to both universities and colleges as well as businesses to conduct R&D. The remaining 71% comes from the private sector.

If the bulk of the investment in R%D comes from the private sector, how is Wisconsin positioned? Nationally, the most R&D intensive industries tend to be chemical (including pharmaceutical), professional, scientific, technical and information services, information services, transportation manufacturing as well as computers and electronics. If Wisconsin has a high level of activity, such as employing a large share of people, in these same industries, we would expect that Wisconsin is well-positioned to benefit from investment and innovation. Wisconsin, unfortunately, has relatively low levels of employment in these particularly high innovation industries. The distribution of national R&D shares across industries and Wisconsin employment shares appears to place Wisconsin at a comparative disadvantage. Given Wisconsin's industrial composition, the state appears to be in a poor position to benefit from national trends in innovation and growth in these sectors.



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