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# Government Patenting and Technology Transfer

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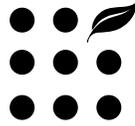
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**Paul W. Heisey, John L. King, Kelly Day  
Rubenstein, and Robbin Shoemaker**

## Abstract

Intellectual property rights such as patents protect new inventions from imitation and competition. Patents' major objective is to provide incentives for invention, sacrificing short-term market efficiency for long-term economic gains. Although patents are primarily granted to private firms, policy changes over the last 25 years have resulted in greater use of patenting by the public sector. This study examines government patenting behavior by analyzing case studies of patenting and licensing by the Agricultural Research Service (ARS) of the U.S. Department of Agriculture. ARS uses patenting and licensing as a means of technology transfer in cases in which a technology requires additional development by a private sector partner to yield a marketable product. Licensing revenue is not a major motivation for ARS patenting. More widespread use of patenting and licensing by ARS has not reduced the use of traditional instruments of technology transfer such as scientific publication. Once the decision has been made to patent and license a technology, the structure of the licensing agreement affects technology transfer outcomes. As commercial partners gain experience with the technology and learn more about the market, mutually advantageous revisions to license terms can maintain the incentives through which private companies distribute the benefits of public research.

**Keywords:** Patents, licenses, intellectual property rights, technology transfer, Agricultural Research Service, agricultural research and development

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## Summary

Intellectual property rights—patents, copyrights, and trade secrets, for example—protect new creations from imitation and competition. Patents provide an incentive for invention by granting a proprietary right to generate income from the invention—temporarily limiting the number of suppliers in a market. In granting patents, short-term market efficiency is sacrificed for long-term economic gains. Society in return gets new products and services, as well as voluntary disclosure of the technology needed to create them, which is made public upon grant of the patents. Major legislative and other developments in U.S. intellectual property rights (IPR) policy over the past 25 years have resulted directly or indirectly in greater use of patents by the public, as well as the private sector. These measures have generated considerable analysis of IPR policy.

The private sector depends on clearly defined and enforceable property rights for markets to function. Patents exist to restrict the use, sale, and manufacture of inventions and thereby to stimulate private sector investment in research and development. The Federal Government also holds numerous patents on inventions and discoveries from successful public research.

### What Is the Issue?

Why does the government need to patent at all? Patent rights are a means not only of capturing revenue but also of providing a mechanism through which publicly owned laboratories and other government research facilities can widely distribute a technology they have developed. Patent rights on Federal research are typically licensed to corporate partners, providing incentives for further development into commercial products—from prototype to near-market readiness. Awarding patents to government entities also can raise awareness of public research results; patents can also be employed defensively to promote wider use of a research tool if it seems likely that another entity might patent a similar technology in order to restrict access.

If a primary public policy objective behind government patents is to widely distribute the benefits, how well is that objective being achieved? Little analysis has been done on patenting as a means of technology transfer from Federal laboratories. This report examines government patenting behavior by focusing on patenting and licensing by USDA's Agricultural Research Service (ARS) as a means of technology transfer.

### What Did the Study Find?

Patenting and licensing can be consistent with the objective of widespread distribution of the benefits of ARS research. A technology that reaches society through private sector development of ARS research provides more net social benefits than a technology that is not developed at all because no private firm commercializes it—provided technology transfer activities do not withdraw too many resources from ARS's most important missions. This conclusion is likely applicable to other Federal research agencies as well.

ARS has been patenting and licensing innovations primarily as a means of technology transfer, not as a means of generating revenue to finance research. ARS licensing revenue only partially funds the operations of its Office of Technology Transfer (OTT), and only makes up 0.3 percent of the ARS total budget. An important factor in the ARS patent-application process is the likelihood of finding an acceptable partner for commercialization of the technology.

Increased patenting and licensing by ARS has not reduced the number of traditional instruments of technology transfer, such as scientific publications. From 1990 through 2003, as ARS patenting and licensing—and other newer means of technology transfer—increased, scientific publication counts for ARS remained relatively stable.

The ARS Office of Technology Transfer is often compared with university OTTs. Although both are nonprofit institutions, they have different objectives. Protocols for technology transfer through licensing are more restrictive for the Federal Government than for universities. The Federal Government follows specific guidelines to ensure transparency and fairness in its licensing arrangements. All other things equal, first preference for federally licensed technologies is given to smaller firms (typically fewer than 500 employees).

Determining the success of licensing terms and practices is very difficult—the success of a license depends on market size, market characteristics, and technology characteristics, and is subject to both “technology risk” and “appropriation risk.” “Technology risk” refers to the probability that a technology can be improved and developed into a feasible commercial product or process that is an improvement over available alternatives. “Appropriation risk” is the likelihood that a company will be able to earn profits from the new technology and not have them captured almost entirely by competitors. Potential market and technology parameters (e.g., size and characteristics) are often not known in detail when licenses are negotiated.

ARS does retain some flexibility in renegotiating license terms. The relevant market size and characteristics may become clearer over time. Similarly, different characteristics of a particular technology may turn out to have greater market potential than initially envisioned. *Ex post* flexibility can correct *ex ante* mistakes in predicting technology success or failure.

Also, licensing to more than one firm is more likely to be successful if the market is segmented geographically or by stages in a production process than if all firms are competing for the same market niche. Co-exclusive licensing when licensees are direct competitors for the same market niche can reduce collaborative efforts with ARS inventors in product development.

Federal research agencies differ in size of research budget, markets for possible commercial applications of their research, and management structure. Further research would be needed to determine how this report’s specific findings might apply to practices in other agencies.

## How Was the Study Conducted?

The study relied on two principal areas of analysis. The first was four case studies of technologies developed, patented, and licensed by ARS. The case studies were selected through consultation with the ARS Office of Technology Transfer (OTT). The authors interviewed scientists responsible for the inventions, ARS patent advisors who helped to determine patentability, and representatives of the eventual licensees. Secondly, the study drew on information from an earlier Economic Research Service (ERS) study that examined licenses of ARS technologies by research area and by characteristics of the technologies' social benefits.

The authors compared data on technology transfer, including data on patenting and licensing by ARS, with data from other institutions such as private firms, U.S. universities, and other Federal laboratories. This was accomplished through a review of the literature on the use of patenting and licensing by these different types of institutions, and analysis of data from the U.S. Patent and Trademark Office, the Department of Commerce, and ERS's Agricultural Biotechnology Intellectual Property database, available at: <http://www.ers.usda.gov/Data/AgBiotechIP>.