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**Producers as Investors in Agricultural Research: Searching for Alternative Funding
Strategies in Land-Grant Universities**

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Producers as Investors in Agricultural Research: Searching for Alternative Funding Strategies in Land-Grant Universities

Vincent Amanor-Boadu and Yacob Zereyesus¹

Abstract

This research begins the effort to identify the effect of new models of relationships between producers and researchers in land grant universities in the area of innovation and commercialization. We argue that since producers are becoming increasingly significant funders of university researchers, the benefits of the Bayh-Dole Act could be accelerated for universities if they formed commercialization partnerships with these producers. Contrary to the expectation that allowing such relationships will adversely affect the universities and their researchers, we aim to show that there will actually be a positive benefit to both producers and institutions.

The three legs of land grant universities are teaching, research and extension. They have made major contributions to the growth in productivity of U.S. agriculture in ways that make it unique in the history of agricultural development. At the center of the land grant university's mission for agriculture is the State Agricultural Experiment Stations (SAES) which manage and orchestrate the majority of the research effort in land grant universities. Despite their role in fostering knowledge development and transfer, the SAES have been experiencing financial challenges due to general decline in funding and political support to Universities (Armbruster 1993).

Agricultural producers have been experiencing significant financial challenges over the past few decades, judging by the sources of farm family incomes. For example, Fuglie et al. (1996) reports that only about 15 percent of total farm family income originated from farm activities. This leads one to wonder why the relationship between producers and colleges of agriculture researchers has not seen much alteration over the last many decades vis-à-vis research funding. Agricultural producers have been major contributors to research in land-grant universities through the funds disbursed by the various commodity commissions and associations. The rationale for these disbursements is to advance solutions to commodity agriculture.

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Xia (2003) estimated that return to public investment in agricultural research and development is in excess of 40 percent, compared to between 18 and 20 percent earned in the rest of the economy. If this is so, then why have producers and colleges of agriculture treated producer investments in agricultural R&D the same ways as public disbursements in university research efforts? Would it not make sense to develop new strategies to transform these investments from being hijacked by others through a conscious recognition of agricultural producers as investors in primary and applied research efforts in land grant universities? How would such a shift affect the behavior of both producers and researchers and what impact would it have on the economic well-being of producers and universities?

Suppose producers and land-grant universities develop a new relationship that transforms producers from grantors into investors and the land-grant university researchers from recipients of these grants into R&D partners in a commercialization initiative. Suppose the producers position themselves as commercialization partners in the discoveries that emerges from the researchers' efforts. This research is focused on assessing the system dynamics of such a shift in perception and explores the strategic initiatives that need to be developed to create such a transformation. We hypothesize that the benefits from such a shift in the relationship will accrue to both the university and the producers because there will be a greater focus on creating results that contribute to more resources to accelerate the creation of those results.

The next section of the paper reviews the literature on university research and analyzes the funding trends that have confronted these institutions over the past several decades. Next, we develop a model of the new relationship and show how it could transform the funding challenges confronting the university and meet the demands of agricultural producers. We test the hypothesis that this shift could be beneficial to both producers and researchers by simulating producer investments over a decade, using information from the Kansas soybean initiatives. We conclude by identifying the gaps in our research and how we see future research addressing them.

The Unseized Opportunity

Agricultural Research funding in the public and private sectors has been generally increasing in absolute terms. The rate of increase is much higher in the private sector than the public sector (Figure 1). Land grant universities thrived during a long period of increased funding, but now face declining political and financial support (Armbruster 1993). The proliferation of state funded colleges and universities competing with land grant institutions, among many, further exacerbates this problem (Schuh 1993).

Broadly speaking, the funding arrangements for the State Agricultural Experiment Stations (SAES) may be categorized into four major groups: public funding; private sector funding for public research; private or public sector contracts; and intellectual property fees. The public funding programs have different formats but they all come from general tax revenue at the federal or state level. They may be formula funding or program funding and they may be competitive or specially allocated for specific activities. Federal and state appropriations to SAES declined between 1960 and 1996 but federal government research funding and private research funding both increased during the same period. For example, while regular federal appropriations (Hatch, regional research and other non-grant funding) accounted for 20.4 percent of total SAES funding in 1960, it was only 14.5 percent in 1996. On the other hand, industry, commodity groups and foundations saw their share increase from 7.5 percent to 14.3 percent over the same period (Huffman and Just 1999).

Private sector contracts and grants for public research have been used to address some of the gaps in research funding resulting from the decline in public sector funding. However, there has also been a need in the agricultural firms for high caliber researchers on project basis and universities have been the natural places for such talent (Huffman and Evenson 1993). Federal funding for agricultural research has been stagnant in real terms since 1976, or increased little, if any, over the last two decades, in spite of evidence that the return on investment is very high. (Huffman and Evenson 1993) while private spending tripled between 1960 and 1992 (Fuglie et al.

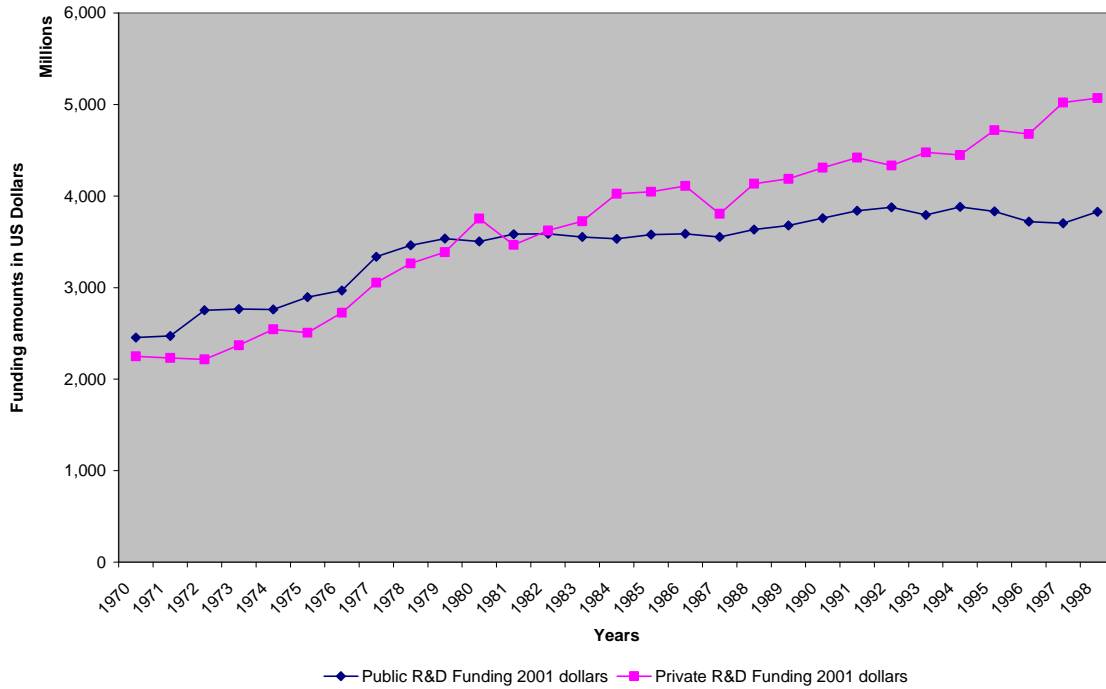
1996). Today, the private sector is as important as the public sector in funding and performing agricultural research (Xia 2003).

Intellectual property encompasses patents, copyrights, plant variety protection certificates and trademarks. The focus in most universities has been on patents and they have been aggressively patenting and licensing their discoveries (Fuglie et al.1996). With a patent an individual or company can use or license the use of an invention that is embodied in a product, process, or biological material (for twenty years). This gives the inventor a right to an income stream associated with the invention.

AUTM tracked the license income in 2005 from patents and other intellectual property owned by its members amounting to 1.5 billion. In the Fiscal year 2005, a total of 527 new products introduced into the market (3641 introduced from 1998 through 2005), 628 new spinoffs created (5171 since 1980), 28,349 current active licenses (each single license represents a one on one relationship between a company and a university) and 4,932 new licenses signed (AUTM 2005).

Figure 1. Agricultural research and development funding sources in the US

Agricultural R&D Funding Sources



Source: Public Numbers based on data from the National Science Foundation and USDA Current Research Information System

Private Numbers based on Klotz, Fuglie and Pray (1995), updated by Klotz- Ingram through 1998

The Association of University Technology Managers (AUTM) (1998) estimates that from 1980, when the Bayh-Dole Act was passed, to 1998, patented inventions originating from academic institutions increased from only 390 to 2,681. The rapid increase in the number of patents secured by universities is indicative of the creativity that is embedded in these institutions. The challenge that has confronted these institutions is the commercialization of these discoveries since that was the purpose of the Bayh-Dole Act.

We believe that the mission of the land-grant university has not traditionally included the commercialization of discoveries. Thus, there has been a need for a paradigm shift in these institutions for their researchers and administration to take full advantage of the benefits of the Bayh-Dole Act (1980). For example, in a recent survey conducted by the authors, a small but

significant proportion of researchers in the Kansas regent University system believed that the purpose of the university is to generate ideas and make them available to the public to advance the welfare of society, not to generate money. They see this commercialization effort as an adverse effect on scholarship since it increases protectionism of ideas and constrains collaboration. Indeed, when it was pointed out that they are already conducting research contracts for corporations, some saw this as an antithesis of the mission of the university, claiming it dilutes the independence of the institution when research become too close to corporations. These concerns notwithstanding, it is important for these institutions to explore potential opportunities that may exist in developing alternative relationships with different funding sources to enhance their research funding situation.

From the foregoing, we observe that universities have had to deal with the declining research funding from the federal government by looking for alternative sources of funding. The Bayh-Dole Act opened one such funding avenue, but the data shows that the commercialization effort at most universities has been at best lukewarm, thus limiting the potential presented by the Bayh-Dole Act. There are many reasons for this gap between patents and commercialized research outputs, but the principal one may be the disconnection between what researchers believe to be interesting research questions and what the market demands as necessary solutions to its problems. The challenge of this disconnection is exacerbated by the debate on the role of public universities in the technology commercialization marketplace. Some believe that a public university's mandate does not extend to the commercialization of its research outputs. The publicly-funded institution's mandate, they argue, is to create knowledge and disseminate it freely to the public. Yet, others suggest that the declining public funding of these Universities demand a more entrepreneurial outlook from its intellectual capital if they intend to maintain their research programs (Powers 2003).

There is a way to bridge this debate by improving our understanding of the different relationships between university researchers and research funding sources. For example, while

results from publicly-funded research may be argued to a public good, universities have increasingly been funded by private organizations on a proprietary basis. While there may be arguments about the extent to which this proprietary research work should be pursued in public universities, there is no argument that they do help focus researchers attention on market-relevant initiatives.

Changing structure of funding sources and the implications to the future of land grant universities

Perhaps a more fundamental transformation of the land-grant system has been the "privatization" of research activities generated by declining funding. Efforts to enhance the short-term private profits tend to generate outputs that compete with products that could be provided by the private sector (at a cost). Because of budget constraints, this leads to neglect of public goods that are not produced elsewhere (Huffman and Just 1992) and redirect public resources (Just and Rausser 1993). Some public goods that would be underemphasized according to private interests include basic research with output in the form of knowledge (scientific literature), social science research on new institutions and policies, analysis of labor displacement effects of new technologies, and safety and environmental research on new biotechnologies and chemicals (Huffman and Just 1992).

The private sector allocates about 10% of its agricultural R&D funds to SAES research. These funds come as research contracts or grants largely for innovations to benefit a private firm or a particular commodity group. That is, they have the purpose of financing discovery of private goods rather than public goods. Open sharing of R&D results is seldom in the private sector's interest. Alternatively, it is generally in the best interest of private firms to seek exclusive rights to innovations from projects that they fund in public research institutions. With private-sector funding of SAES research, private-sector interests can also redirect public resources (e.g., uncommitted state and formula funds and services of publicly financed fixed capital in research

equipment, facilities, plots, and herds) to the pursuit of private interests. Such leveraging of public funds can greatly change the composition of innovations produced. These issues are emphasized by Huffman and Just (1995) and Lyons, Rausser, and Simon (1996). The long-term outcome could be a reduction in the willingness of state and federal tax payers to fund public agricultural research (Just and Rausser 1993).

More basically, declining budgets have increased the need to rely on private sector funding which, unfortunately, causes a relatively larger share of research activity to be reoriented. As a researcher's marginal research time is directed toward satisfying a specific private need, the generation of new ideas and interests tends to be geared toward those interests. In addition, research activities are often not completed within estimated time frames or budgets, so discretionary time and money is likely to be reallocated toward the private commitments that are more formal. In this way, private companies can "leverage" their research funds. As a result, the university research agenda becomes controlled by private concerns, and publicly funded institutions provide research (at less than social cost) that would otherwise be undertaken privately. Because public research funds are scarce, research that produces public goods thus tends to be neglected (Huffman and Just 1992).

Reconciling the basic mission of land grant universities and the ever changing sources of funding for R&D?

If public funding of SAES stagnates or decreases, the ability of SAES to accomplish their mission will be diminished. However, an increase in private funding of agricultural research is not incompatible with the mission of SAES. In fact, private research is absolutely essential if the findings of public research are to be transferred to practical applications. Public and private food and agriculture research projects are both different and complimentary. They are often different components or phases of a process leading to successful commercialization or other uses of new technology and information (Holt and Bullock 1999).

The agenda of SAES research will continue to be influenced by the source of financial support. The important thing is that research results not be influenced. The food and agriculture sector continues to grow in size and complexity. Strong public support will be necessary if SAES are to collaborate effectively with the private sector and at the same time address issues of broad public interest, including social impacts of new technology, human health, food safety, environmental quality, and natural resource conservation (Holt and Bullock 1999).

Toussaint (1981) expressed the concern that we do not end up with all of our research oriented toward immediate applicability and/or relevancy. We will have to exert strong efforts to keep a reasonable proportion of our research funding allocated to projects where the immediate impact is not so clear and to projects of significance to society as a whole.

Model Description

This research explores alternative arrangements between producers and land-grant institutions to achieve a commercialization channel for research output to increase both producer incomes and research funds. It draws on the technology commercialization literature (Wong 2006; Phan and Seigel 2006) and data on research outcomes and potential market opportunities to assess some scenarios of the potential economic effects should such a policy shift be made. We use a system dynamics modeling approach to evaluate alternate structural arrangements for this relationship between producers and research institutions (figure 2). The basic assumption of our thesis is that because land-grant universities are not in structured to commercialize their research output, developing relationships with producer organization may provide a commercialization channel. We also show that such a relationship allows land-grant universities to meet their mandate to increase producer well-being. We test hypotheses pertaining to strategic arrangements that can provide incentives for producers to not only make consistent investments in research efforts at land-grant universities, but collaborate with researchers in defining research questions that enhance potential commercial outcomes for research efforts. We show a hierarchy of these

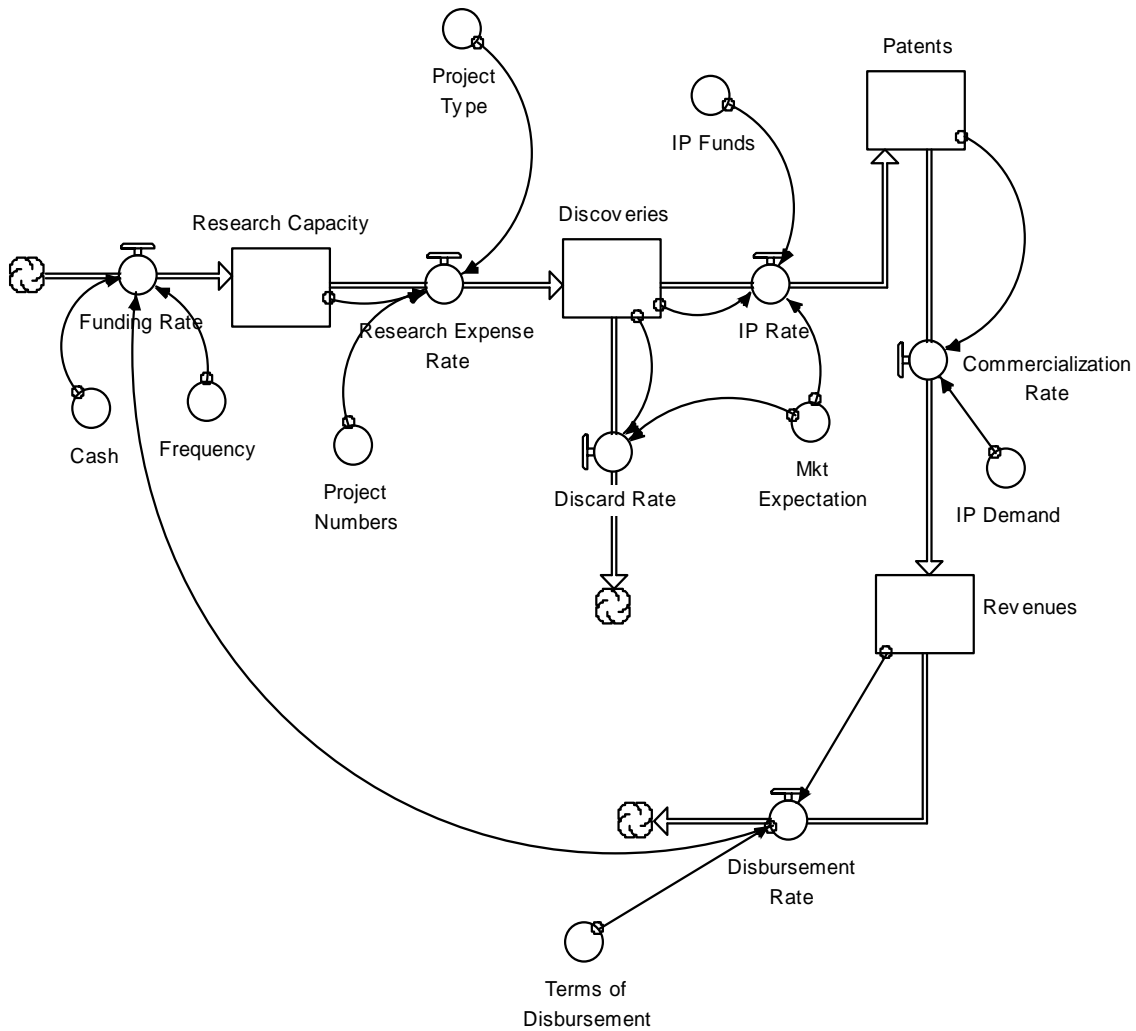
arrangements and their relative ability to facilitate the development of effective commercialization routes for research output and their related potential economic effects on both producer and universities.

The new proposed mutual relationship between Land Grant universities and agricultural producers will bring desirable outcomes. Primarily, the source of funding for sustainable R&D at land grant universities is addressed at this point. Having been struggling to secure a sustainable funding for R&D, these Universities will definitely have a broader basis for funding, provided that an arrangement is done with the producers to increase their contribution. It is good to reiterate here that, in various occasions, the contribution of producers to R&D has been reported grossly as part of the public funding. This paper advocates the treatment of these producer organizations funding under private funding. This is not only to name it differently, but by so doing create a new avenue for the producer organizations to partake in various stages of R&D in the land grant universities. At the same time, Successful commercialization of R&D outcomes via the producer organizations will also increase the flow of income to producers.

Moreover, the new linkage will also induce a number of positive impacts to the existing R&D. Unlike other funding sources, for example federal sources such as formula funding, producers will be able to help define and refine R&D composition. This will make the research out comes to be more relevant and address issues of concern to producers first hand.

Equally important is the envisioned effect of the involvement of producers in the R&D process. Among others, it will greatly shorten the length of time between a research is defined and the outcome is realized.

Figure 2: System dynamics frame work of the proposed relationship between land-grant universities' R&D and agricultural producers



Conclusions

The paper identifies the challenges of implementing such a strategic shift in the relationship between producers and land-grant institutions. For example, it argues that because producer contributions to research has been treated essentially as ‘grants’ without any rights obligation, universities may find it difficult to make the shift. The fact that the proposed relationship brings about a shift in the institutional organization will likely cause resistance from the land grant universities themselves.

Similarly, it indicates that producer organizations need to develop internal capabilities to harvest the benefits of this relationship. There is also a question of producer willingness and

readiness to extend their contributions beyond mere funding. We argue that the primary difficulty may be the developing new perspectives on their roles in their members' financial well-being beyond advocacy.

There is also the concern that private funding of R&D will cause the neglect of research on public goods that are not produced elsewhere and redirect public resources.

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