



Book Review: From Agriscience to Agribusiness: Theories, Policies and Practices in Technology Transfer and Commercialization (Innovation, Technology, and Knowledge Management).

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“Agribusiness has assumed a greatly expanded role in driving innovation in agriculture over the past generation. The appearance of new scientific opportunities and an evolving set of strategies for protecting intellectual property have driven rapid growth in both upstream and downstream research investments, a frantic pace of merger and acquisition activity, and have induced major changes in how the public and private sectors interact. This volume brings together new evidences on the current functioning of the agriscience agribusiness system for generating and delivering agricultural technology.”

From Agriscience to Agribusiness: Theories, Policies and Practices in Technology Transfer and Commercialization is part of the Springer book series *Innovation, Technology, and Knowledge Management*. This book, the first in the series to focus on agriculture, is motivated by the editors' belief that "a clear understanding on how to nurture innovation, from concept through development and all the way to the end user, is vital to our future" (p. 1). The literature on this topic has expanded rapidly, making this a welcome effort to advance our understanding of the intersection of science and agriculture. This volume provides a useful interdisciplinary forum for academics and decision-makers to update and expand their view of the agriculture and food innovation system.

Section I of the book provides a broad empirical foundation for the remaining chapters of the book through data-rich chapters devoted to examining public and private sector agricultural R&D. The chapters in this section make it clear that legal, economic and social forces have induced a "shifting the division of labor of the private and public sectors in agricultural innovation" (p. 3) over the past decades. The academic literature on agricultural innovation has not kept pace with this shift. Pardey et al. (pp. 13-40) show just how heavily existing literature remains focused on the public sector. Of the 2829 evaluations that they analyze in their chapter, 88% focus on research carried out by public agencies. The private sector data used in the four chapters of Part I remove any doubt about the magnitude of the rise of the private sector in agricultural

R&D, and set the stage for discussion of the nature of the institutional interactions undertaken in the remaining sections of the book.

Sections II & III flesh out the modern institutional architecture for innovation in agriculture. The mechanisms and attention given to managing intellectual property are much different today than they were in the past and continue to evolve. The feedback between the legal environment, financial flows, industry structure and the trajectory of the agricultural sector is complex. The accessible chapters in these sections contribute to our understanding of the research to commercialization chain. These sections serve to provide context for the structural changes that are empirically documented here and in the previous section. Technology flows between the public and private sector, and among private sector firms are examined using data sets that complement each other in the detail that they provide. The growth of agribusiness research investments, and the rapid pace of merger and acquisition activity are related to the appearance of new scientific opportunity and to the new strategies for protecting intellectual property. Patent ownership and patent citation data are brought to bear on the difficult-to-observe transfer of technology within the private sector.

US public universities have struggled to deal with changes in the legal environment for intellectual property protection. In particular, the Bayh-Dole Act “granted substantial rights to recipients of federal funds to patent and license inventions resulting from that research and made federal policy broadly and explicitly supportive of public-private

technology transfer.” (p. 5). Little guidance was provided on how publicly funded institutions were to balance their mandate to generate public goods with the new potential to generate revenue from their inventions, and universities have pursued a variety of paths. Four chapters examine this interface between public research funding and technology diffusion. Two chapters dive into the role played in the innovation system by the science and technology effort of the US Land Grant system using data on funding and scientific output (research publications) broken out by contribution by area of research. A chapter on Land-Grant use of patents and plant variety protection certificates is a nice companion to a chapter on private sector intellectual property protection activity. Two other chapters provide detail on the role and operations of university technology transfer offices.

The transfer of technology to farmers is examined in Section IV. A vast literature exists on technology adoption by farmers, and many extension models have been proposed, modified and trialed worldwide. Despite the attention that has been given to these topics over the past 50 years, no consensus on either organizational principles for extension nor on the most important barriers to adoption has emerged. The two literature review chapters mount credible efforts to synthesis this literature, and the two empirical chapters provide interesting case studies, yet I feel that much work remains in our quest to identify the key to unlocking this final step in the agriscience to farmer continuum.

The final section of the book cuts across some of the themes of the previous book sections, focusing on the benefits of agricultural research and innovation. The first four chapters of Section V have value as standalone examinations of the topic, yet this is the least integrated section of the book. The final chapter by the editors is compact, comprising just eight pages of the nearly 500 page volume. The editors provide a concise summary of the dense array of ideas, data and questions presented in this volume. They stop short of providing a synthesis of what has been learned and are light in providing direction for future research. Given the quality of the material contained in the book, I would have liked to see them go further.

Where does this volume book fit among existing literature, and who would find it most valuable? The greatest contribution is in filling the gap between studies that look at public sector research and studies that examine agribusiness. The term “innovation system” is often used with vague reference to that whirl of forces and activities that link advances in knowledge to improved technologies deployed by farmers. The rich detail on research investment and technology sharing within the agribusiness sector and across the private and public sector illustrate the extent of those linkage, and identify the forces that are driving the “shifting division of labor”. A reader of this book will no longer view universities as isolated providers of public goods research, nor will she view the private sector as concerned only with product development R&D. The volume serves as a valuable resource to researchers currently

focused on either end of the upstream/public vs. downstream/agribusiness continuum who are looking to better understand the incentives driving either public or private sector investments.

Where could this volume have gone further? The book takes on an ambitious scholarly task – that of extending the existing literature on innovation by providing new data and a new perspective on intra-firm technology flows and by providing new details on public sector interactions with the private sector within the U.S. Four chapters of the book are devoted to international topics. These chapters - case studies of university technology transfer experiences in Canada and the Netherlands, of public sector research in Brazil, and of a specific technology project in Sub-Saharan Africa - feel orphaned from the central focus of the book. I would have liked to see a more explicit incorporation of the topic of agricultural trade. Agricultural trade is growing rapidly, intellectual property jurisdiction is a major component of modern trade agreements, and multinational companies are far and away the largest investors in agricultural research. How is this globalization of technology generation and transfer impacting and being impacted by the US innovation system?

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