HARNESSING PUBLIC RESEARCH FOR INNOVATION IN THE 21ST CENTURY

An International Assessment of Knowledge Transfer Policies

 Universities and public research institutes play a key role in the innovation ecosystem. Many countries have implemented national strategies to support the commercialization of knowledge produced by public institutions, to help take their innovations and scientific breakthroughs to market and ultimately boost economic growth. Research bodies themselves have also introduced practices to support knowledge transfer activities.

The legal, policy, and institutional approaches to knowledge transfer are diverse, and there is no standardized set of assessment metrics relevant to both high- and middle-income countries. In this context, how can policymakers best help countries and institutions improve the efficiency of their knowledge transfer practices to maximize innovation-driven growth and to seek practical solutions to critical societal challenges?

Comprised of research and insight by esteemed international contributors, Harnessing Public Research for Innovation in the 21st Century addresses this policymaking challenge. It assesses the current role of public research institutions in modern innovation systems and considers how to best optimize existing policies, based on inputs from leading academics, practitioners, and policymakers. It analyses what does and does not work in knowledge transfer practices, policy options, and future measurement priorities, and looks in detail at three high-income and three middle-income country examples. The book provides a useful foundation for future empirical work, the development of appropriate metrics, and for crafting new innovation policy approaches.
“This book represents a major step towards reaching a systematic approach to the measurement of knowledge transfer practices and outcomes.”

Hu Zhijian, President, Chinese Academy of Science and Technology for Development

“Unlike most existing work in this area, this book emphasizes that firms benefit from academic research not only through formal but also more informal channels and from open science, and that there are tensions, as well as complementarities, between these two.”

Bhaven Sampat, Associate Professor, Columbia University

“Enabling access to cutting-edge research is vital to tackling the challenges countries face, and for policymakers, it is thus ever more important to identify which knowledge transfer practices work and which do not. This research is critical in this regard.”

Pippa Hall, Director of Innovation and Chief Economist, Intellectual Property Office, United Kingdom

“This book does an excellent job of identifying key metrics that should be measured by knowledge transfer offices.”

Ragan Robertson, Technology Transfer Officer, University of California, Los Angeles, and Association of University Technology Managers (AUTM) Cabinet Member, Metrics and Surveys, United States of America

“Brazil has established a comprehensive legal framework for innovation. But is that enough? There are barriers that can only be overcome with continuous adjustment of policies. In this context, this book provides good guidance.”

Antenor C.S. Corrêa, Senior Analyst in Science and Technology, and Fernanda V.M. Magalhães, Specialist in Public Policies and Government Management, Federal Government of Brazil

“Going forward, knowledge transfer will play a pivotal role in driving future growth in Africa. We welcome this book and encourage the African measurement community to invest in related metrics.”

Philippe Kuhutama Mawoko, Executive Secretary, African Observatory for Science, Technology and Innovation, African Union Commission
Intellectual property (IP) is at the heart of modern economic life. In many countries, investment in intangible assets is growing faster than investment in tangible assets. Policy makers – whether in rich or poor economies – seek to promote an IP framework that is conducive to innovation and economic growth.

The series *Intellectual Property, Innovation, and Economic Development* intends to inform such policy initiatives through rigorous scholarship. Each book in the series examines a major aspect of the interface between IP, innovation and economic development. Economic analysis is complemented by contributions from other academic disciplines to present the latest scholarship and consider its real-world implications. The series builds on studies by the World Intellectual Property Organization, reflecting the research interests of the international policy-making community.

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Harnessing Public Research for Innovation in the 21st Century
An International Assessment of Knowledge Transfer Policies

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FOREWORD

HU ZHIJIAN

President, Chinese Academy of Science and Technology for Development

Promoting public–private partnership knowledge transfer is one of common notice among countries at different economic development levels. A vital question for policymakers today is how to improve the efficiency of these knowledge transfer practices, maximizing innovation-driven growth.

No unique knowledge transfer blueprint is recognized as time-tested and universally optimal. The Chinese government has been continuously highlighting and facilitating the transformation of scientific and technological achievements into real productive forces. The Chinese knowledge transfer law, Promoting the Transformation of Scientific and Technological Achievements, entered into force on October 1, 1996. An amendment to the law was adopted at the meeting of Standing Committee of the Twelfth National People’s Congress on August 29, 2015, and came into force on October 1, 2015. The modification mainly includes: refining the science and technology performance assessment system, improving the scientific and technological achievements disposal and distribution right systems, perfecting the market pricing mechanism of scientific and technological achievements, strengthening the awards for main scientific and technological contributors, and so on. Meanwhile, lots of high- and middle-income countries have been developing their national law and policies for spurring on the commercialization of publicly funded inventions. Unfortunately, it is not straightforward for policymakers to access information on what works and what does not. Initial evidence indeed suggests that different approaches are needed for different stages of economic development and even for specific sectors. Nevertheless, these experiences and lessons need refining to be used by political makers.

With this in mind, in 2015, under the auspices of the World Intellectual Property Organization (WIPO) and most of China, a joint research project on knowledge transfer policies and practices was
initiated with the support of some countries. Two such academic and policy workshops were held with authors and experts in July 2016 and March 2017 to validate the research focus and unify methodologies. We have compiled the main research results into this book.

The main contribution of this book is twofold: To start with, the book develops a conceptual framework to evaluate knowledge transfer practice and outcomes. It provides a six-country study in the same conceptual framework, three middle- and three high-income countries, and also puts forward a standardized set of metrics for assessing national or institutional performance relevant to both high- and middle-income countries’ development. With all these efforts, it is possible to do an international comparison at different income levels. The country cases will reveal a wide range of approaches and a variety of tools for policymakers, professional associations, IP offices, and scholars.

I would like to take this opportunity to express my sincere gratitude to the editors and authors for their great contribution to this book. The research represents a major step toward reaching a systematic approach to the measurement of knowledge transfer practice and outcomes. It lays important groundwork for future empirical work, for the development of appropriate metrics, and for crafting new innovation policy approaches. I look forward to the WIPO contributing further valuable works on innovation, intellectual property, and economic development to better benefit its member states at large.
FOREWORD

PIPPA HALL

Director of Innovation and Chief Economist, Intellectual Property Office, United Kingdom

Knowledge transfer has received considerable attention over the past few decades, and is recognized as playing a key role in a competitive knowledge-based economy. Enabling access to excellent, cutting-edge research is vital to tackling the economic, social, and environmental challenges countries face. Through knowledge transfer, public research organizations can maximize the impact of their research, delivering tangible real-world benefits. For individual businesses, it can enable them to improve performance, increase productivity and gain access to new resources and world-leading expertise. And at a national level, knowledge transfer drives economic growth and delivers social benefits. Internationally, there have been achievements in building partnerships and relationships between businesses, research organizations, and government bodies, to deliver real value. However, challenges remain, not least that of assessing the impacts of knowledge transfer initiatives in order to understand how to improve policies and practices.

This is easier said than done. How do you go about trying to evaluate these impacts? Most data collection, if any, occurs at a national level and there is no standardization of what data are collected. There also needs to be a clear understanding of how the different approaches and different channels of knowledge transfer work, such as the interplay between more open science-type approaches with the formal licensing and collaborative agreements.

This book aims to address these gaps. Its contributors are experts in their fields and provide an international perspective on the different approaches to knowledge transfer. It develops a conceptual framework to enable the evaluation of different knowledge transfer policies and practices, with a standardized set of metrics for assessing national or institutional performance. It also makes a valuable contribution in developing a new methodology for how to measure and assess the global volume and distribution of patenting activities carried out by public
research organizations. The development of a common evaluation framework on the possible costs, benefits, and impacts of knowledge transfer activities is an important step forward, providing a better evidence base on which policy decisions can be taken. By assessing the interaction of existing policies and the underlying innovation system structures, the book identifies what works best under different conditions and makes policy recommendations relevant for both high- and medium-income countries. For policymakers, it is vitally important to identify both what works and what does not work, and in what situations, in order to understand how to improve the efficiency of knowledge transfer activities in order to achieve maximum impact.

I welcome the contribution this book makes to the evaluation of knowledge transfer policies and practices, laying important groundwork for future study and the development of innovative policy approaches.
FOREWORD

BART VERSPAGEN

Director, UNU-MERIT

Knowledge produced or built on by public research organizations such as universities and public research institutes is a vital source of new technologies and organizational methods that can contribute to many of the United Nations’ sustainable development goals, from improvements in food security and health and a reduction in carbon emissions to economic growth. To achieve social and economic benefits of value to these development goals, relevant knowledge needs to be successfully transferred from public research organizations to firms and government organizations that can use the knowledge to improve or create new services, goods or processes.

Knowledge transfer is a complex process that involves multiple actors and channels for transmitting knowledge. The six case studies in this book for three middle-income and three high-income countries illustrate how the design of policies to support knowledge transfer needs to take into consideration the absorptive capabilities of domestic firms, the research capabilities of universities and public research institutes, and the skills of knowledge transfer professionals. For middle-income countries, in particular, these capabilities and skills are in flux. The case studies show how policies and practices to support knowledge transfer need to both promote capabilities and skills and adapt to changing conditions.

The value of this book lies in its implications for policies and practices to support knowledge transfer and in its practical recommendations to collect a comprehensive set of metrics to ensure that all forms of knowledge transfer, both formal and informal, are placed in perspective. The problems associated with a narrow set of metrics focused on patent licensing have been known for some time. This book provides evidence for why a broader set of metrics, covering contractual, consulting, and informal channels, is important to prevent undue emphasis on some forms of knowledge transfer over others.

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UNU-MERIT has been pleased to support some of the work behind this book, both through the contributions of Anthony Arundel and by hosting a workshop in Maastricht in March 2017 to discuss the conceptual framework provided in Chapter 2 and the six case studies in Chapters 4 to 9. The results should be of value both to future research on knowledge transfer and to the design of policies and practices that are adapted to specific conditions within countries and within individual universities or research institutes.
PREFACE

Universities and public research institutes play a key role in enabling the application of scientific breakthroughs and innovations in the marketplace or by government organizations. Their present and potential future contribution to the production and application of knowledge to innovation is undeniable.

To further leverage this role, many countries – developed and developing alike – have implemented national strategies to support the application or commercialization of knowledge produced by public research organizations. In addition, individual universities and public research institutes have introduced practices to support these activities, for instance, by including knowledge transfer to promote innovation as a core part of their mission.

As a result, a vital question for policymakers – and the enquiry of this book – is how to improve the efficiency of these knowledge transfer practices to help maximize innovation-driven growth and/or to seek practical solutions to critical societal challenges.

Unfortunately, it is not straightforward for policymakers or knowledge transfer practitioners to access information on what works and what does not. Countries and institutions have garnered substantial experience with diverse approaches. Yet this information has not been distilled in a way that can provide policy guidance for specific sectors or for countries at varying levels of economic development.

With this in mind, the book pursued the following three objectives:

• to develop a conceptual framework to evaluate knowledge transfer practices and outcomes
• to improve knowledge transfer metrics, surveys, and evaluation frameworks, resulting in a standardized method to assess national or institutional strategies in an internationally comparable way
• to generate findings on what works and what does not, and to propose related policy lessons.

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In pursuit of these objectives, we, as the editors of this book, laid particular emphasis on three important realities.

Number one: Public–private knowledge transfer occurs through a large number of formal channels, such as licensing intellectual property (IP), contract research, and contracting, as well as through informal channels, such as the sharing of research results via personal contacts or by “open science” methods, including conferences and publications. It is important to avoid casting these channels in a mutually exclusive way. Indeed, the many forms and facets of these two channels are often not in contradiction; they have fuzzy boundaries in many cases, and they can be complementary and mutually reinforcing.

Number two: Mirroring the above point, policy options are also more numerous and less binary than implied by commentaries that either focus single-mindedly on knowledge transfer policies based on IP as the only way forward or caution that the formalization of knowledge transfer – and, to some extent, the privatization of the application of knowledge – are serious threats to the functioning of a science system based on the free flow of knowledge. In reality, institutions and countries do not have to choose between these two opposites or two radically distinct policy options. Many nuanced policy approaches are possible.

Number three: No country or institution has yet to uncover the ultimate law or tool that provides a silver bullet for achieving effective knowledge transfer to potential users. Economies and institutions worldwide still have untapped potential to better harness the role of public research for innovation. Knowledge of possible relevance to critical topics such as food security, climate change, or health remains tied to books, journals, and the scientific realm without making sufficient impact on innovation and the realities around us. Much of this knowledge may not be being used for other reasons, for example, because the right regulatory systems are not in place or because multiple other complementary activities are needed before it can be put to use. But the potential is clearly there. This is a source of frustration but, first and foremost, also of important hope for the years to come as we get better at making public research more useful to economies and societies worldwide.

These three points are recurrent themes that underlie this book. They also make the topic of this book timely and particularly important.

Many institutions and individuals deserve thanks for their contributions. The main trigger for this book was a discussion and agreement in 2016 among the then minister of the Ministry of Science and Technology...
of the People’s Republic of China (MOST), Wan Gang, and WIPO’s director general, Francis Gurry, that more international work is needed in the field of knowledge transfer practices.

Under the minister of MOST, Wang Zhigang, this book’s work with respect to China and a workshop were subsequently financially supported and coordinated by Lin Xin, DG, Zhang Jiejun, (Deputy Director General, DDG), Sun Yongjian (former DDG), and Zhang Bingqing (DDG), all from the Department of Policy, Regulation, and Innovation System within MOST.

For their steady support to this the project, we are also indebted to the Chinese Academy of Science and Technology for Development (CASTED) and its President Hu Zhijian. In particular, we thank Chen Baoming, DDG, and Juan Yang, who was supported by CASTED to work as a WIPO fellow for more than a year on this project, and the staff of the CASTED Institute of Comprehensive Development.

In addition, there are many individuals and other organizations to thank for their help with this book – too many to list. First and foremost, special thanks go to the outstanding authors of the country studies that accompanied this project for close to four years. It is rare to be able to work with such an outstanding cast of academics from Asia, Europe, and Latin America. This rollcall was complemented by notable experts from IP offices, by knowledge transfer practitioners, and by leading policymakers. Particular thanks to the South African National IP Management Office, the IP Office of the United Kingdom, and the Korean IP Office, as well as the Brazilian Ministry of Science, Technology, Innovations, and Communications. Rosa Fernandez at the Department for Business, Energy, & Industrial Strategy, Adrian Day, Lorena Rivera León, and Antanina Garanasvili provided data and analysis for Chapter 1.

We would also like to thank all participants for their contributions to two associated workshops on the International Comparison of Knowledge Transfer Policies and Practices. The first was held with MOST and CASTED in Beijing, July 2016, and the second at the United Nations University, Maastricht Economic and Social Research Institute, on Innovation and Technology (UNU-MERIT) in March 2017.

This collaboration also showed that knowledge can flow in all directions. While high-income economies and their institutions have extensive experience with knowledge transfer policies and practices, many new experiences are emerging in middle-income economies such as Brazil, China, India, and others. These innovative experiences are a possible source of learning for all other countries.
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Thanks for substantive comments go to the editorial advisory board of this book series, Mark Wu, Megan Macgarvie, and Beth Webster, as well as the academic reviewers of this project, Fabio Montobbio and Bhaven Sampat, and also to Carsten Fink, WIPO’s chief economist.

Excellent editing was provided by Tobias Boyd, then at WIPO. The project management support and oversight by Charlotte Beauchamp, Head of Publications and Design at WIPO is acknowledged with thanks.

We hope that this book will open a window to future work assessing the diversity of knowledge transfer policies and practices. Its purpose is to lay the groundwork for future empirical work, for the development of appropriate metrics, and for crafting new innovation policy approaches. Ideally, the survey and evaluation framework can also be deployed by WIPO or by other organizations to yield comparable data from multiple countries over time.

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