

Book Review: Handbook of Technology Transfer

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ABSTRACT

Written by a plethora of expert contributors from a range of institutions, the *Handbook of Technology Transfer* provides an engaging deep-dive review of technology transfer as a complex and dynamic process, applying different mechanisms characterizing activities in a variety of countries. The handbook takes a fresh look at how technology transfer comprises at least four dimensions: the underlying mechanism of transferring knowledge; the role of individuals that trigger the transfer; the role of institutions where the transfer takes place, and lastly the role of governments and politics.

KEYWORDS

Construction Industry, German Scientist, Knowledge Transfer, Principal Investigator, Public Finance, Regional Innovation, Third Mission, University-industry Collaboration, Work-family Initiative

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Split into four distinct parts, this insightful handbook fully examines each of these dimensions and the roles that each of them plays in technology transfer, highlighting university institutions in Europe and North America in particular. Forward-thinking, it also delves into future innovation implementation in emerging economies where resources are limited, and the challenges faced as a result.

Part 1, "Knowledge Transfer", includes Chapter 1 through Chapter 3. The first chapter takes the form of an interpretative essay based on the large body of work on technology transfer, in an attempt to elaborate an economic theory of technology transfer to add to the rich literature on the specific mechanisms that enable advanced economic systems (Audretsch, Lehmann & Wright, 2014). It develops the notion of the limited transferability of knowledge, building on analysis of the competences required to use economic goods in general and knowledge as a particular economic good. It analyses the effects of the limited transferability of knowledge on its appropriability, on the economic influence of knowledge spillovers, on the tradability of knowledge and on its recombinant production, exploiting the notion of Jacobs increasing returns to variety.

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Knowledge is generally perceived as a key resource that may ultimately contribute to economic growth. Although knowledge creation constitutes the prerequisite for innovation processes and subsequent economic activities, the underlying mechanisms thereof are not well understood. Whereas the linear model of innovation posits a unidirectional sequence of basic and applied research, current research shows that a fuller model of innovation is needed that considers the cross-fertilization of basic and applied research. The purpose of Chapter 2 is to conceptualize a theoretical model of regional innovation output, taking into account the knowledge flows from basic to applied research and vice versa (Zheng & Bao, 2022). This chapter thereby emphasizes the role of the government as an enabler and facilitator of knowledge creation and diffusion. Ideally, basic and applied research funding would act synergistically in the production of regional innovation output. This chapter contributes to our understanding of the optimal mix of basic research funding and applied research funding and provides the basis for empirical investigations. It thereby addresses the question how to make best use of basic and applied research resources and derives implications for science and innovation policy.

Research on the role of public finance, knowledge transfer, and firm productivity in their ability to innovate responds to the rapidly growing interest in the subject. Chapter 3 builds and estimates a theoretical model using 17,859 innovative firms in the United Kingdom to demonstrate the extent that various sources of external knowledge contribute to a firm's innovation and the role of access to finance for innovation (Latifi, Nikou & Bouwman, 2021). While access to finance may limit innovation, in particular in the most productive firms, it is public finance that bestows knowledge transfer to firm innovation.

Part 2, "Individuals", includes Chapter 4 through Chapter 6. Scientists in the principal investigator (PI) role are at the heart of knowledge creation and management within innovation and entrepreneurial ecosystems. The original knowledge they create through knowledge discovery forms the basis for technology transfer and commercialization activities. There has been a growing empirical focus on different aspects of the PI role and how scientists in the role pursue knowledge creation and exploitation. However, to date there has been no research and empirical attention on how principal investigators approach knowledge management. The purpose of Chapter 4 is to address this deficit and to present a micro foundation conceptual framework that focuses on exploration and exploitation knowledge domain focus and know-how, opportunity and environmental scanning and knowledge management practices (Christofi, Vrontis & Cadogan, 2021).

Considering the sequential nature of nascent entrepreneurship and business ownership, Chapter 5 examines the propensities of academic entrepreneurs to be business owners (Hayter, Fischer & Rasmussen, 2022). A theoretical model sets up the empirical analysis based on survey data from a large German public research institute. Traditionally, scientists and entrepreneurs have been seen to occupy opposite ends of a spectrum in terms of their role in innovation. In academic entrepreneurship the two combine on a number of activities. In order to understand the ways in which academic inventors move from pure patenting to nascent entrepreneurship to business ownership and connect seemingly divergent activities. This chapter models their behavior by looking at various factors among German scientists. Academic inventors present a critical case since science and entrepreneurship are often seen as radically different, not the least in terms of knowledge production. By bringing the analysis from the level of social behavior and roles to the level of knowledge production, questions can better addressed such as: How is knowledge in the interfaces of epistemic communities produced? How can such knowledge be organized and sustained? How can relations between individuals on 'opposing sides' be constructively managed? The empirical results show that scientists' positive attitudes towards commercialization of results consistently contribute to tendencies towards academic entrepreneurship; however, the academic discipline and risk aversion did not have a statistically significant impact. Having a doctoral degree lowered the propensities toward nascent entrepreneurship, but had the opposite effect on business ownership. Finally, age and experience made business ownership more likely. The results of this study would contribute to a more general theory of how scientists can combine their commercial and scientific activities in spite of an alleged divergence.

There are many factors that influence a company's innovation and technology transfer goals, among them, recent research has emphasized the role of the workforce and employees. Management, psychology, and economics literature have been dedicating a growing attention to the topic of "work-family initiatives" (WFIs). The objective of Chapter 6 is twofold. First, it aims to shed light on the role of WFIs in the context of SMEs and on their effect on innovation as explored by the literature until now. Second, it aims to offer a research agenda on the effects of WFIs on innovation and technology transfer in SMEs, and particularly in family SMEs.

Part 3, "Institutions", includes Chapter 7 through Chapter 10. Technology and knowledge transfer often depends on direct collaboration between those who develop new knowledge and those who apply this knowledge. Chapter 7 provides an overview of the phenomenon of university-industry collaboration and the inherent drivers and barriers in this relationship. Many studies show that university-industry collaboration is highly beneficial for the innovativeness and performance of firms. Still, there are many obstacles that hamper effective collaboration between academia and industry. Based on the scientific research in this area, this chapter provides an overview of key drivers and barriers to university-industry collaboration. With particular emphasis on research partnerships, this chapter outlines specific drivers and barriers related to the connections between university and industry partners, differences in their organizational culture, the role of organizational characteristics, and the types of relationships. This chapter concludes by providing some suggestions for practice for how to improve university-industry collaborations.

In Chapter 8, the author takes a business-related contextual perspective into the technology transfer literature, and focus specifically on understanding what is known and what is still to be explored in terms of technology transfer in the construction industry. This chapter takes the construction industry as a representing an interesting setting for a review with a contextual dimension for several reasons, like, at least in Europe, the construction industry has often been considered a mature, traditional industry, often conservative and attached to familiar technology, but heavily challenged by an increased global competition, urging the firms in this industry to engage in innovation. Furthermore, next to synthesizing current knowledge, and contrasting it to the tech transfer literature in general, this chapter also presents a research agenda for future research into this intriguing field.

German higher education institutions fulfill three missions: the education of students and academic staff, research, and the so-called "third mission", which refers to the transfer and impact of university outputs to the economy as well as society. In order to successfully fulfill these tasks, the German higher education system is based on two main pillars: public universities, which are first and foremost responsible for basic research and a more theoretical education, and "Universities of Applied Sciences", focusing on a practical education and application-oriented research. In the past, the prevailing opinion was that especially public universities play an important role when it comes to knowledge spillovers and technology transfer. Research has also been focused on the importance of public universities for regional as well as national prosperity. Chapter 9 focuses on the role of Universities of Applied Sciences for technology transfer, especially in rural areas where many small and medium-sized enterprises (SMEs) are located. As these companies are the backbone of the German economy, specialized in the high-tech manufacturing and engineering services as well as production, it is important to understand how cooperation with higher education institutions can be successfully put on its feet. Furthermore, a comparison with other European countries provides insights on the organization and mission of similar institutions of higher education.

Global Crisis improves the level of uncertainty and makes it difficult for firms to assign an expected value to various outcomes. The inertia inherent in decision-making under uncertainty within incumbent organizations reflects what has been termed as the knowledge filter. Given the central role of university in the triple helix model and its relevance for knowledge spillover entrepreneurship Chapter 10 focus on how this role is evolved and changed in US during the time and why it is so relevant in time of crisis.

Part 4, “Countries”, includes Chapter 11 through Chapter 14. The establishment of academic spinoffs is a multi-faceted phenomenon, involving individual-, institutional-, and contextual-level factors. Chapter 11 reviews the literature on the motivation to establish academic spinoffs and link it to the regulatory and policy framework. This chapter documents the evolution of this phenomenon in Italy, where 1,626 academic spinoffs have been established between 1981 and 2018. The author argues that it is likely, for some of these spinoffs, that graduates or PhD students establish spinoffs out of necessity entrepreneurship rather than opportunity entrepreneurship, as a “pushed alternative” considering the small opportunities of stable jobs or career progress. The academic career is indeed a highly selective job path and who cannot remain in the system may be interested in spinning out a company to exploit to some extent the knowledge previously developed. The evidence of a high survival profile of this type of firms, despite not high growth rates, is coherent with the motivation leading to their establishment.

Academic entrepreneurship is an important mechanism for the transfer of scientific knowledge and technology into application in society. Specifically, the creation of academic spin-off firms has become a growing phenomenon being promoted by universities and policy initiatives across the globe. The factors leading to a higher number of spin-offs being created are well documented, but there is less evidence on the performance and impacts of these firms over time. Chapter 12 takes a unique approach by documenting the development and outcomes of a national population of academic spin-offs over time. By looking at spin-offs from universities and public research institutes in Norway established from 1999 to 2011, this chapter maps their profiles related to origin, technology, financing, outcomes and several performance measures. The findings provide a comprehensive understanding of how these firms develop, emphasizing the importance of different outcomes such as acquisitions, the skewed nature of such firm portfolios, and the strong effect of time for realizing outcomes and impacts.

Universities are important contributors to national and regional economies. Since the enactment in the US in 1980 of the Bayh-Dole Act, which transferred the ownership of federally funded research to universities, a worldwide debate has been ongoing about the benefit of universities’ ownership of intellectual property (IP). Chapter 13 reviews different policies regarding universities’ ownership of IP and their impact. This chapter then focuses on the case of Canada. Canada does not have an IP ownership policy at either the federal or provincial levels. However, some universities have created their own ownership policies. This contribution is both direct—via employment, purchasing, and taxes—and indirect—via the future impact of students and university research.

Private and public resource scarcity is a critical problem in emerging economies. Although technology transfer policy frameworks exist, innovation and entrepreneurial become complicated processes by the highest R&D opportunity-costs. It explains the emergence of frugal innovation that involves doing the best with the available resources to solve society’s problems and needs. However, little is known about the relationship between knowledge transfer and frugal innovations. The last chapter investigates the scarcity of resources and the technology transfer framework in frugal innovation ecosystems. Our results show the frugal social innovation’s obstacles and the crucial role of technology transfer policy frameworks by analyzing the Chilean case. The chapter contributes to the re-conceptualization of the frugal innovation approach and provokes the discussion about the promotion of frugal social innovations through technology transfer on the road to a sustainable future.

This publication received rave reviews from many scholars. Martin Kenney commented that “This Handbook edited by David Audretsch, Erik Lehmann, and Albert Link is an important contribution to the canon on university technology transfer. Written by well-known academics, each of the chapters examines either vital issues in technology transfer or national technology transfer recipes. It will be essential reading for scholars, policy-makers, and practitioners interested in the current state of thinking about technology transfer”.

Donald Siegel said that “This timely and important Handbook should be on the bookshelf of any scholar interested in the managerial or public policy implications of technology transfer. Its global scope and blending of new developments in both theory and practice are especially attractive.

The editors have assembled a distinguished, interdisciplinary group of scholars, which is entirely appropriate, given the nature of the topic. Technology transfer spans a number of fields within the social sciences, business administration, and engineering, including management, economics, geography, sociology, and public policy studies. Each of these fields is represented in this cross-cutting volume. A “must-read” for anyone interested in this topic”.

Paul Zielinski acclaimed that “This book brings together a number of informative perspectives that go in depth on the importance of technology transfer. The breadth and scope of the studies presented provide deep insights into the theory and practice needed to enhance economic development based on the development and deployment of advanced technologies into the marketplace. The authors draw together a set of international experiences and examples, delivering a unique global perspective”.

This enlightening handbook is an excellent resource for scholars of business management, economics and information technology. It is also of great interest to policy-makers of innovation and entrepreneurship given its in-depth look at technology transfer and innovation.

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