KNOWLEDGE SHARING AMONG SCIENTISTS

Why Reputation Matters for R&D in Multinational Firms

PRESCOTT C. ENSIGN

Knowledge Sharing among Scientists

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with a foreword by
Melissa M. Appleyard

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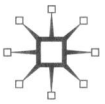

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Knowledge Sharing among Scientists

To my first professors, Mom and Dad.

Foreword

Economic progress depends on innovation, the vast majority of which requires some degree of human interaction. The inherently human process of innovation requires the cultivation of new knowledge, followed by its embodiment in a product or service. Even the process followed for the research contained in this book illustrates the interpersonal path of innovation where a survey generated by scholars in Boston—Stephan Schrader and Eric von Hippel—made its way to Berkeley where I conducted my Ph.D. research and then to HEC Montréal, where Prescott Ensign crafted his dissertation that produced the material for this book. Ensign's research extends the knowledge sharing studies in the steel industry conducted by Schrader and von Hippel and my research in the semiconductor by examining knowledge sharing in another R&D-intensive industry—the pharmaceutical industry.

This book constitutes a profound contribution to the knowledge sharing literature by detailing the forces influencing the intrafirm exchange of knowledge and extends our understanding of social exchange theory by examining the role of reputation in the knowledge-sharing process. In terms of the likelihood of knowledge sharing, Ensign's setting could be viewed as an optimal one for knowledge flows: The potential knowledge sharers are scientists who work for the same life science firm. One might expect this population to share knowledge freely given their presumed allegiance to their scientific disciplines and desire to advance knowledge in their quest to improve and save lives. Furthermore, because Ensign asks the scientists about their knowledge-sharing activities within their firms, concerns over knowledge leakage to competing firms is not a primary consideration.

What is so surprising about Ensign's findings is that even in this seemingly ideal "agar" for knowledge sharing, impediments exist to the free flow of knowledge. In particular, reputation of the knowledge requester in the eyes of the knowledge source is found to be influential. The findings presented in this book can help knowledge workers understand how their personal tendencies in assessing the reputations of others—particularly related to expected future behavior—may shape their professional behavior. R&D managers also will greatly benefit from this research when

forming innovation teams, facilitating communication within teams, and making decisions regarding the geographic distribution of innovation team members. With the increased pervasiveness of social networking, these lessons will be met with avid interest.

Specifically, the innovation process demands that knowledge is articulated, deployed, and refined, and as Ensign demonstrates through statistical analyses based on data collected from over 200 pharmaceutical scientists, this process is a social process fraught with interpersonal considerations even in a science-based industry. The findings show that while pharmaceutical scientists share knowledge regularly, they do take into account past and, in particular, probable future interactions with their knowledge-sharing partners. For the purposes of modeling this social behavior, Ensign defines a potential knowledge recipient's "reputation" as a combination of past interactions and likely future interactions with the knowledge source. With data collected through questionnaires distributed to scientists employed in pharmaceutical R&D operations in Canada and the United States, he tests whether reputation is associated with the likelihood of knowledge sharing.

A major strength of this research is that Ensign disaggregates reputation into its component parts. As noted above, the two primary dimensions he focuses on are past interactions between the knowledge source and the potential recipient and anticipated future interactions. What is really elucidating for the purposes of management practice is that he breaks these two dimensions down even further. Past interactions are defined by personal/professional interaction, co-work/co-locate interaction, duration of interaction, and frequency of interaction. The characteristics of potential future interactions included in this study are predictability, reciprocity, and obligation.

The statistical analyses of how these components of reputation are related to knowledge sharing tell a compelling story. A number of Ensign's findings support expectations regarding the importance of reputation for professional relationships. For example, he finds that the duration of interaction in the past is positively related to the likelihood of sharing. Similarly, the three components of potential future interactions all were found to be associated with knowledge sharing as hypothesized—predictability and reciprocity being positively related and the level of obligation (i.e., how much the potential recipient "owes" the source) being negatively related. Strikingly, the other three components of past interactions, either were not significantly related to knowledge sharing (frequency of interaction) or were found to be negatively associated with knowledge sharing (personal/-professional interaction and co-work/co-locate interaction) when they were expected to enhance it.

It would be of great interest for future studies of intrafirm knowledge sharing to replicate these analyses in different industries to determine whether these findings are unique to pharmaceutical scientists. It could be that reputations important in the knowledge-sharing calculus are built through distinctive mechanisms in the life sciences where past interactions receive less of a weight than potential future interactions. This could be because of the drive to be on the frontiers of science rather than dwelling on the past.

Ensign also uncovers some nuances that merit note. For example, he finds that it is not merely the frequency of past interactions that may create a platform for knowledge sharing, but rather frequency coupled with obligation. This suggests that scientists are well aware of the value of knowledge that they give and receive and the frequent sharing of trivial knowledge does not necessarily build to a feeling of obligation. Ensign's measure of obligation covers both past interactions between the source and the recipient and interactions between the source and the R&D group to which the recipient belongs. Because working in groups is common in R&D-intensive settings, the inclusion of group relationships is a valuable contribution of this research.

While the importance of reputation for knowledge-sharing decisions is the central focus of this research, Ensign also considers a number of additional variables that provide a more complete picture of the R&D environments in which the scientists operate. He is able to characterize the scientists by stage in the R&D process (where preclinical researchers were less likely than clinical researchers to receive requested knowledge); by physical location (where greater distances impeded knowledge sharing); by the degree of ease in sharing the knowledge (where substantial time and/or effort requirements would deter a source from providing the requested knowledge); by organizationally mandated relationship (where being on the same team or in the same unit would increase the likelihood of knowledge sharing); and by degree of recipient need (where knowledge sharing was heightened when the knowledge would make a major contribution and the potential recipient would find it difficult to generate the requested knowledge or locate another source). Our understanding of these variables that influence intrafirm knowledge sharing is deepened by quotes throughout the book that Ensign collected via interviews.

While Ensign asked scientists about knowledge-sharing activities within the boundaries of their firms, broader lessons can be drawn about the calculus of knowledge sharing. An understanding of this calculus can improve managerial practices that facilitate productive knowledge flows. As firms refine their R&D strategies, including experimenting with an

"open innovation" approach that draws on external expertise, with help from this book, they can set their expectations more realistically in terms of the likelihood that knowledge sharing will actually take place.

Moving from an intrafirm to an international scale of innovation, the power of knowledge sharing can be seen in numerous settings. The Internet has greatly facilitated the convening of the global intellect by reducing the time required to identify pockets of pertinent knowledge, to assess its merits through peer review, and to deploy it in a form valued by users. The development of open source software like the Linux operating system and online resources like Wikipedia provide two well-known examples. In addition to time savings, these sorts of innovative activities based on global knowledge sharing typically result in goods and services that are superior in quality if the peer-review process functions well. Consistent with Ensign's findings, reputation appears to play a critical role in motivating participants to contribute their knowledge to these types of efforts.

Innovations produced through these instances of global knowledge sharing have been viewed as a threat to the business models of established firms. For example, Linux has eroded Microsoft's dominance in computer operating systems in a number of markets and Wikipedia has forced encyclopedia vendors to alter their approach to assembling and packaging content. Even absent these direct threats to established strategies, a whole host of firms are experimenting with the so-called "open innovation" approach popularized by Henry Chesbrough. Corporations like Procter & Gamble (P&G) are actively soliciting external ideas to complement their internal R&D activities. P&G's Connect + Develop program can be seen as a deliberate shift in innovation strategy from one where collaborative innovation is feared to one in which knowledge sharing with external parties is essential. Harnessing the global intellect is seen as the path to future growth not the root of pernicious competition. The idiosyncratic knowledge-sharing activities examined by Ensign have transformed into a systematic approach to innovation in many industries.

This book can assist managers who wish to facilitate the requisite human interactions to make advanced R&D possible. One can anticipate that the need for widespread collaboration across subject-matter experts will intensify as R&D matures and knowledge from myriad disciplines is fused to produce the products and services of tomorrow. Ensign touches on the importance of interdisciplinary R&D in the pharmaceutical industry, and other industries are grappling with the communication challenges that such R&D elicits. For example, the semiconductor industry is dependent on R&D conducted at the nanoscale, which requires knowledge from biology, chemistry, electrical engineering, physics, and so on.

While cooperation may be mandated, informal knowledge flows often are central to the success of innovation, and Ensign's research offers invaluable insights into the mechanisms driving these flows.

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June 12, 2008

Preface

This book explores the role one social form of exchange governance plays in the occurrence of technological knowledge sharing among R&D scientists in the same firm. *Technological knowledge sharing* is the informal voluntary conveyance of intermediate scientific know-how from one R&D scientist (source) to another R&D scientist (recipient). This study fills a gap in the literature by exploring the relationship between reputation and the interpersonal intrafirm sharing of technological knowledge in an environment where R&D work (innovative activity) is embedded in a social context and is broken down physically, organizationally, and by area of technology. R&D workers in the same firm, though comprising a social community, may work in different locations, may be separated by organizational boundaries (e.g., departments), and work in different scientific disciplines.

The academic issue central to this debate concerns the role of social governance devices, reputation in particular, in exchange of resources; specifically, the exchange or sharing of non-codified technological knowledge. Social considerations function as an instrument of exchange between members of a firm, providing recompense for services performed and motivating their future performance (La-Valle 1998). The link between reputation and reciprocal interests challenges the standard transaction cost view of exchange that excludes the impact of social mechanisms of governance and repeated interaction. The following question for empirical investigation arises:

> What effect does an R&D worker's reputation have on a second R&D worker's decision to share technological knowledge with the first individual, when both are in the same firm?

Knowledge and entrepreneurial knowledge-creating activities are the foundation of firm capabilities (Iansiti and Clark 1994). Questionnaire data and supporting interview data illuminate attributes of reputation (at the individual and group level) conducive to the voluntary sharing of timely, relevant, technological knowledge among R&D scientists in the same multidivisional, multinational firm.

The thesis put forth is that where R&D work takes place within a social setting, *reputation*—based on (1) history, or past behavior and (2) expectations for future action—influences the occurrence of technological knowledge sharing. The favorable reputation of a potential receiver is posited to facilitate his or her acquisition of technological knowledge from another. If the seeker of assistance has a positive reputation, from the source's perspective, this will affirm the source's decision to share technological knowledge. A positive reputation is conceptualized as emanating from (1) favorable behavior, either directly exhibited, first-hand observation or experience relayed by known others, and (2) expectation for future favorable behavior, including assurance that sanctions inherent in the social community can monitor and enforce actions. From this definition of reputation, the premise is that reputation provides a basis for the informal, voluntary communication of nontrivial technological knowledge.

To give focus to this research, the study examines an R&D worker's decision to provide or not provide personal technological knowledge to another R&D worker in the same firm. Analysis is based on a questionnaire circulated to R&D scientists in firms within the pharmaceutical industry. It was found that the dimensions of reputation, past behavior and expected action, do have bearing on the knowledge-sharing decision. Surprisingly, the past behavior dimension of reputation is not uniformly indicative of the flow of scientific know-how. The expected action dimension of reputation, however, is a strong predictor of the circulation of technological knowledge among scientists engaged in innovation.

The constituent elements of past behavior are *nature of interaction* (revealed as personal/professional interaction, co-work/co-locate interaction), *duration of interaction,* and *frequency of interaction.* Contrary to hypothesis, *personal/professional interaction* and *co-work/co-locate interaction* are negatively related to technological knowledge sharing among pharmaceutical scientists in the same firm. Consistent with theorizing, duration of interaction is positively related to sharing technological knowledge among pharmaceutical scientists in the same firm. Frequency of interaction was not found to be statistically significant in explaining the decision to share technological knowledge.

The elements of expected action are *predictability, reciprocity,* and *obligation* (initially believed to be part of reciprocity). As hypothesized, predictability and reciprocity are positively related to sharing scientific know-how among pharmaceutical R&D scientists in the same firm. As anticipated, obligation (one R&D scientist's debt to another) is negatively related to a second R&D scientist's decision to share scientific know-how with the first scientist.

Providing support for relationships as modeled, personal/professional interaction is positively related to predictability, frequency of interaction is positively related to reciprocity, and co-work/co-locate interaction is positively related to obligation.

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