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# Optimal allocation of ownership rights in dynamic R&D alliances

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## Abstract

We explore the dynamic evolution of property rights regimes in R&D alliances using the incomplete contract approach pioneered by Grossman, Hart, and Moore. In contrast to the standard analysis, the productive asset is an excludable public good such as a patent. Moreover, both firms can decide whether to disclose their know-how and invest effort. Know-how that has once been released cannot be concealed later. We characterize different scenarios in which the optimal ownership structure may change over time due to a trade-off between inducing know-how disclosure and ensuring maximum effort.

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## 1. Introduction

This paper offers a new perspective on the optimal allocation of ownership rights within dynamic R&D alliances. As an illustration, consider collaboration in software development between two companies. Each company has specific abilities that are valuable for two successive joint projects, e.g., knowledge about the application at which the new products will be aimed, experience with particular platforms, expertise regarding Internet technologies, and so on. While disclosure of such intangible know-how has an important impact on the success of the alliance, it is often not verifiable. Moreover,

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success will certainly depend on how much effort the companies invest, which may also be nonverifiable. What can be contractually determined is the allocation of control rights over the productive assets, i.e., a property rights regime.

In the by now customary property rights approach based on incomplete contracts and the hold-up problem as outlined by Hart (1995),<sup>1</sup> it is usually assumed that the assets that are controlled by the owner are pure private goods such as machines or buildings. In contrast, we argue that when discussing the organization of R&D activities, the most crucial assets controlled by the owner such as patents on innovations may well have the properties of excludable public goods. In addition to unilateral control by either firm *A* or firm *B* (i.e., a vertical relationship), we thus consider two forms of horizontal partnerships in which *A* and *B* have equal power: either both parties have veto-power (the usual definition of joint ownership), or both parties are free to use the asset without the partner's consent.

We study the choice between the different vertical and horizontal property rights regimes when the two firms both decide whether to disclose know-how to each other and both choose effort levels. It turns out that under plausible circumstances, the ownership structure that is optimal for inducing know-how disclosure may not be optimal for inducing maximum effort and vice versa. The trade-off between disclosure and effort has interesting consequences if the R&D cooperation consists of two stages or is extended over two projects. For example, assume that the companies in our illustration develop a second edition of a software product, say with more features or for a different platform. We find that change of the ownership structure over time may be an equilibrium phenomenon. To see why the ownership structure that is optimal in the first project may not be optimal for the second project, notice that know-how which has once been released to the other firm cannot be taken back, and is hence also available to the other firm in the second project. Whether or not know-how has already been exchanged in the first stage thus affects the optimal ownership structure in the second stage. This may help to explain the prevalence of dynamic R&D alliances with evolving property rights even if straightforward explanations such as changing market environments do not apply.<sup>2</sup>

More specifically, consider the following situation. Suppose that there is an early stage and a later stage. In each stage, given the property rights regime, party *A* and party *B* noncooperatively decide whether to disclose their know-how and choose their effort levels. A party can either release its know-how at the early stage (which is efficient), or at the later stage, or never. In contrast, effort exertion at the early stage does not necessarily imply effort exertion at the later stage. After the parties have made their decisions, they learn the surplus that can be generated by collaboration (which is always ex post efficient) as well as the default payoffs that they can realize on their own (which depend on the ownership structure). Following Hart (1995), we assume that the parties split the collaboration surplus

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<sup>1</sup> See the seminal papers by Grossman and Hart (1986) and Hart and Moore (1990), and cf. Schmitz (2001) for a nontechnical survey of the recent literature.

<sup>2</sup> The fact that alliances are often dynamic is, e.g., a topic addressed in the empirical studies of Bleeke and Ernst (1995), who find that in their sample the median life span of an alliance is seven years, and Chan et al. (1997), who report an average life span of about five years. Based on their study of alliances between US and Chinese firms, Yan and Gray (1994) argue that joint ventures need to reconfigure over time to ensure overall performance.

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