Managing Product Innovation Spillover in Sourcing

Firms are increasingly specializing in their core competences and are becoming dependent on suppliers for other value-adding processes. Moreover, such suppliers could also be competitors of a firm in the same or related markets. In such settings, the firm’s sourcing decisions cannot just focus on optimizing value, but have to take into account strategic considerations, i.e., actions of potential supplier partners. In particular, some of the firm’s proprietary knowledge could become exposed to the supplier through potential sourcing-related interactions. (In this paper, we focus on the settings in which the knowledge spillover risk cannot be mitigated through patents; e.g., some innovations are not patentable; competitors can find ways to circumvent patents.)

We develop an analytical model to study the strategic sourcing decision for product innovations in the presence of spillover risks. A notable common assumption in the existing literature on knowledge spillover is that the transferred knowledge has a known positive value (e.g., Pacheco-de Almeida and Zemsky, 2012; Chen and Chen, 2014; Wang et al., 2014). In contrast, the key feature of our model is that the added value of innovation is ex-ante uncertain and could be negative. We establish that the optimal sourcing decision depends on the type of innovation, namely whether the realized value of innovation could have negative impact on the product value, and whether the innovation could be immediately adopted by a competitor.

In particular, we differentiate two types of product innovations in our model.

The first type can be thought of as an innovation that potentially increases the product value without jeopardizing it, i.e., without any downside risk (e.g., an innovation that adds a feature to a product without replacing or affecting other existing features). We refer to this type of innovation as an *incremental innovation* (e.g., the iPhone 4’s Retina Display). In many situations an incremental innovation is technological in nature, and in such settings innovation adoption requires access to the technology, e.g., supplier partnership with the innovator.

The second type of innovation can be thought of as an innovation that fundamentally alters the product’s design concept, and, therefore, could either increase or decrease its value (e.g., an innovation that introduces
a new feature to replace an existing feature on a product). We refer to this type of innovation as a *disruptive innovation* (e.g., the touch-based keyboard on the original iPhone). Since the essence of a disruptive innovation is in the design concept, it could be immediately adopted by competitors once the product is available in the market, even if they were not involved in its production.

To address the strategic decision-problem of a firm facing innovation spillover risk, we build a game theoretical model with three firms: an innovator, a competitor-supplier (a competitor in the end-product market who is also a potential supplier for the innovator) and a non-competitor-supplier (who is not a competitor in the end-product market and focuses only on production). The innovator’s strategic decision consists not only of choosing a supplier (either the competitor-supplier or the non-competitor-supplier), but also of setting the optimal order quantity. The competitor-supplier needs to decide if and when to adopt the innovation (either immediately or after the value of the innovation is realized, provided access to innovation), as well as the production quantity for its own product. The timing of the innovator and the competitor-supplier’s production quantity decisions is modeled either by Cournot competition (if choosing simultaneously; the innovator and the competitor-supplier are market co-leaders), or by Stackelberg competition (if choosing sequentially; the innovator is the Stackelberg/market leader and the competitor-supplier is the Stackelberg/market follower).

For incremental innovations, we find that when the innovator sources from the competitor-supplier, and thus allows the competitor-supplier to adopt the innovation, it could be optimal for the competitor-supplier to give up market co-leadership in exchange for the operational flexibility of deciding the output quantity of its own product after the value of innovation is realized. This can be thought of as the *real option value of waiting* for the competitor-supplier. Therefore, we establish that there are settings in which the innovator creates value by “selling” this “real option” to the competitor-supplier, who in return willingly “pays” for it by waiting for the innovation value uncertainty to be resolved before making the quantity decision and thereby giving up market co-leadership. This suggests that the innovator may strategically source from the competitor-supplier, enabling innovation adoption via such “real option” offered to the competitor-supplier who maximizes value by exercising it.
For disruptive innovations, we establish a different structure of the optimal strategic decision for the innovator. The innovator’s decision here is driven by the possibility of realized innovation uncertainty having a negative impact on the product value. In such settings, it could be optimal for the innovator to allow for immediate innovation spillover by sourcing from the competitor-supplier. This enables sharing the innovation’s potential downside risk, i.e., the risk of the realized value of innovation turning out to be negative, should the competitor-supplier immediately adopt the innovation, i.e., before the uncertainty is resolved. Such innovation spillover and its early adoption by the competitor-supplier can be viewed as an insurance policy for the innovator, “paid” by giving out market leadership position.

In summary, we show that the innovator’s optimal strategic sourcing decision involves making the tradeoffs between managing innovation spillover risk and (not-) securing market-leadership position. Furthermore, we show that the exact nature of this tradeoff depends on the structure of uncertainty in the product value that innovation brings.

References