By Paul Belleflamme, 9 October 2013

Mixing patents and trade secrets for complex innovations

In our latest working paper, Francis Bloch and myself analyze the optimal protection strategy for an innovator of a complex innovation who faces the risk of imitation by a competitor.

Complex innovations

A "complex innovation" is an innovation that can be fragmented into a set of sub-innovations. Although the possibility exists to patent each sub-innovation, innovators may decide to keep some or all of them secret. Such patent-secret mix is common in the food industry where recipes, lists of ingredients or formula are kept secret, while cooking, manufacturing or packaging processes are patented. Here are some well-known examples:

- Kentucky Fried Chicken holds secret the recipe of 11 herbs and spices that go into its fried chicken, and owns, e.g., a patent on "Device and method for frying and grilling";
- McDonald keeps secret the Big Mac special sauce, and has patented "Method and apparatus for making a sandwich" and "Device and method for cooking food on a grill";
- Coca-Cola's syrup formula is a trade secret, but the company also owns patents on "Coffee cola beverage composition" and on "Beverage preservatives";
- The overall formula to obtain the Ferrero's Nutella paste is kept secret but packages for food or devices responsible for creating specific food are patented; e.g., Ferrero holds patents on "A container with several compartments" and "Improved solid honey composition and process of manufacture".

Combinations of patents and trade secrets are also documented in other industries. For instance, Perng Pan and Mion (2010) describe the strategy of Coskata, a producer of biofuel, that "*has several pending patent applications on the bioreactor segment of the process*", while "*[t]he identity of the micro-organism fed into the bioreactor is protected by trade secret*". The authors further explain that "*this does not rule out the possibility of a patent on the biological component*".

Protection strategies

As illustrated by the previous examples, inventors of complex innovations face a rich set of strategies when it comes to protect their intellectual property. They may indeed choose between patenting and secrecy for each fragment of their innovation, which theoretically opens up a large number of combinations. However, the patent regime that is in force may restrict these possibilities.

- A first requirement for patentability is that the invention be of practical use. A strict enforcement of this *utility requirement* could prohibit the patenting of fragments of innovations. As a result, the innovator would be left with a binary decision: seek patent protection for the entire innovation or for nothing.
- A second requirement is that the invention show an element of novelty; that is, it must show some new characteristic that is not known in what is called the "prior art", i.e., the body of existing knowledge in the technical field of the claimed invention. Hence, a strict interpretation of the novelty requirement could prevent inventors from patenting long held trade secrets.

In our paper, we provide a unified model to study the protection of complex innovations. The model allows us to analyze the innovator's choice of patent/secret mix under various patent regimes, which differ according to the strength of the utility and the novelty requirements. Our *main result* is to find conditions under which the innovator optimally chooses to mix patents and secrets (in a static framework corresponding to a strict novelty requirement), or to patent sequentially two fragments of the innovation (in a dynamic framework corresponding to a softer novelty requirement). It is important to stress that a pre-condition for these results to apply is that the innovator's profit function be concave in the fraction of the innovation that the imitator can exploit. This occurs when the imitator must learn a large fragment of the innovation in order to be able to exploit it usefully. In contrast, if convexity prevails, the innovator will optimally choose an all-or-nothing strategy that consists in patenting the whole innovation or in keeping it altogether secret.

The AIA reform

Noteworthy is the fact that the *American Invents Act* (AIA, passed in 2011) has considerably softened the novelty requirement. Besides the well-known conversion of the U.S. patent system from a "first to invent" system to a "first inventor to file" system, the AIA also eliminates several types of secret prior art. As Maier (2011) explains, this change (which became effective in March 2013) implies that long held trade secrets are now patentable:

> *the forfeiture that previously penalized inventors for maintaining their inventions as trade secrets for some period of time longer than a year is no longer applicable, and inventors are left with the option to practice their invention as trade secrets for now and still patent those same inventions later (assuming, of course, that no other inventor files a patent application claiming the same subject matter first).*

According to our analysis, this change may have positive welfare effects. We indeed find examples where the stakeholders (namely the innovator, a potential imitator and the consumers) are all better off in the most flexible patent regime,i.e., when the innovator is allowed to choose not only to patent initially any fraction of the innovation, but also to patent at a later date any fraction of the innovation that was initially kept secret.

This theoretical result may contribute to the debate that is now under way (see, e.g., here, here and here). *I would like to hear your views about this debated issue*.