Understanding Non-R&D Innovation: Evidence from a Survey of Inventors

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While most research on innovation focuses on the results of R&D projects, there is a growing awareness of other forms of innovative activity. For example, there is a growing body of literature on user innovation, which often involves no formal R&D (Von Hippel, 2005). Recent work on European firms finds almost half of innovation comes from firms that do no formal R&D (Arundel et al., 2008; Huang et al., 2011). Data from the US suggest that over three-quarters of (product) innovating firms do no formal R&D (NSF, 2010). This broader perspective on innovation raises several important questions, including: how common is non-R&D innovation and how does it differ from R&D innovation?; what are the drivers of this form of innovation?; and what are the forms of commercialization for non-R&D innovations?

Non-R&D innovation may be more common for process innovations, when firms have tight links with suppliers, and when market uncertainty is high (Huang et al., 2011). Furthermore, non-R&D innovations may differ from R&D project innovations in terms of the depth, scope and nature of information used (Katila and Ahuja, 2002; Laursen and Salter, 2006). In particular, non-R&D innovation may be more dependent on context-specific, “sticky” knowledge, while R&D innovation may make more use of generalized, codified knowledge (Arora and Gambardella, 1994; Von Hippel, 1994; 2005). Thus, the form of innovation may be closely related to the type of knowledge available in a particular context.

Non-R&D innovations may also differ in terms of their forms of commercialization (in-house use versus licensing). Prior work on forms of commercialization suggests that complementary assets and the strength of IP rights may condition the likelihood of licensing innovations (compared to in-house use) (Gans et al., 2002; Gans and Stern, 2003; Arora and Ceccagnoli, 2006). Based on the above arguments about the importance of contextual information, not only should the licensing rate of non-R&D innovations be lower, but also the commercialization form for non-R&D innovations may be less sensitive to differences in IP rights.

To test these questions, we use data from the 2007 Georgia Tech inventor survey (Nagaoka and Walsh, 2009). The data come from a survey of over 1700 US-based inventors on 2000-2003 priority date triadic patents (patents filed in Japan and the EPO and granted by the USPTO). The survey includes a question on the invention process. We define R&D inventions as those that were: the targeted achievement of an R&D project; the expected by-product of a R&D project; or the unexpected by-product of an R&D project; and non-R&D innovations as inventions that were: “related to your normal job (which is not inventing), and was then further developed in a (research or development) project” or “from pure inspiration/creativity or from your normal job (which is not inventing), and was not further developed in a (research or development) project (i.e., was patented without further research and development costs).” These latter two we interpret as inventions that did not “originate” in an R&D project (although in the first case R&D may have contributed to the final version of the invention). Thus, in this study we take a unique, invention-level interpretation of non-R&D innovation (rather than limiting it to innovations that originate from firms doing no R&D or that come from outside the firm). In addition, our invention-level data allows us to focus on the relation between characteristics of knowledge used (e.g. stickiness, scope or depth) and the type of innovation (non-R&D vs. R&D), controlling for characteristics of firms and industries. The survey and matched bibliometric data include a variety of measures of information sources used, which will allow us to measure stickiness, scope and depth. For example, stickiness may be measured by the low use of published sources and a high use of internal sources of information; information scope may be measured by the number of information sources used at an above average level, or by the number of IPC classes cited in the patent document; and depth may be measured by the overall importance of the most important source, or by the frequency of using a particular source (across all the patents belonging to a firm) (cf. Katila and Ahuja, 2002). The survey also includes questions on the forms of commercialization of the innovation, including in-house use, licensing, use for founding a startup, or not commercialized). We will also incorporate data from the Carnegie Mellon survey (Cohen et al., 2000) to measure the strength of patents in different industries (cf. Arora and Ceccagnoli, 2006).

Our initial analyses of the data suggest that non-R&D invention is not rare, even at the invention level, and even limiting to the case of triadically patented inventions (suggesting that these are more than just marginal inventions). For example, in our data, 26% of firm's triadic patents were from non-R&D inventions growing out of the firm's internal activity (i.e., not simply adoption of outside technology). Also, these are not exclusively (or even predominantly) process-related inventions. Over two thirds of the non-R&D inventions are for new or improved products, although, as expected, the rate of process innovation is higher for non-R&D inventions compared to R&D inventions. These non-R&D inventions have higher rates of forward citations (mean cumulative cites as of June, 2008 is 3.7 for non-R&D inventions versus 2.8 for R&D inventions, $p < 0.01$). The commercialization rate (either in-house, licensed or use in a startup) is similar across the two types of inventions (57% for non-R&D inventions v. 55% for non-R&D inventions). However, as expected, the (unadjusted) rate of licensing is somewhat lower for non-R&D inventions (10% for non-R&D v. 13% for R&D inventions, t-test $p < 0.15$). Thus, these data suggest firms produce a substantial number of important non-R&D innovations, and that there are informative differences between R&D and non-R&D innovations. Based on these promising initial results, we will analyze our data to further understand the nature and uses of this significant but under-studied form of innovation, in order to develop our understanding of the innovation process. The results of this project will be presented at national and international meetings and published in one or more journal articles.

Budget

The budget for this project is $20,000, covering 0.33 months of PI time (Walsh), one semester stipend and tuition for a PhD student (Lee) and materials supplies (detailed budget available on request). The project will run from 15 August 2012 to 14 August 2013.

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