



Policies to promote user innovation: Makerspaces and clinician innovation in Swedish hospitals



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ABSTRACT

As it becomes apparent that users are an important source in innovation in society and in organizations, scholars are realizing that user-directed innovation policy *might* contribute to improving social welfare. How such policy might be designed, however, is uncertain, as are the costs and benefits of such policies. It is also not clear whether there is a problem for user-directed policy to solve, or what that problem is.

As a first empirical step to answering these questions, we report the results of providing hospital clinicians with access to ‘makerspaces’, i.e. staffed facilities with prototyping tools and the expertise in using them.

Findings suggest that almost all innovations developed in the makerspaces are user innovations; that the potential returns from the innovations developed in the makerspaces’ first year of operation are more than tenfold the required investment; and that most of the innovations would not have been developed without access to makerspaces. Due to lack of diffusion, only a limited share of potential returns is realized.

This suggests not only that there are problems of non-development and under-development that policy can solve and that doing so supports social welfare. It also suggests makerspaces as an effective form of user-supporting innovation policy.

1. Introduction

Users are a common and important source of innovation in many sectors of the economy. In all but rare cases, this is likely to be beneficial, both for the individual innovator and for society at large (Henkel and von Hippel, 2005). Yet for all the innovation activity that users engage in, research also suggests that users do not innovate or diffuse their innovations as much as might be socially optimal: many users encounter problems and have ideas without actually developing solutions, solutions may not be developed to their full value potential, and many valuable innovations are not shared (e.g. Lüthje et al., 2005; Kuusisto et al., 2013; Stock et al., 2015; Hartmann and Hartmann, 2015; De Jong et al., 2015). In order to increase social welfare, these problems of ‘non-development’, ‘under-innovation’ and ‘under-diffusion’ could very well be subject to innovation policy, provided of course that there is actually a problem that such policies can solve.

Most countries, however, direct their innovation policies mainly at manufacturers, enacting an essentially Schumpeterian innovation paradigm (Baldwin and von Hippel, 2011). Supporting users’ innovation activities, it has been suggested, may have the effect of heightening social welfare by encouraging more users to innovate, thereby also

encouraging firms to pursue more socially optimal open innovation strategies (Gambardella et al., 2015). User-centric innovation policy, however, is a novel idea and it is not clear how such policy might be designed and what returns might accrue from specific policies.

This paper takes an early step in exploring these questions.

In 2008, VINNOVA (The Swedish Innovation Agency) received a formal request from the Swedish Ministry of Enterprise “... to execute an initiative in order to increase the amount of cooperation-environments for the commercialization of innovations within the health and hospital sector” (N2008/7291/FIN). In response, VINNOVA put into place an “experimental” intervention. The intervention consisted of setting up professional “makerspaces”, staffed innovation assistance facilities with access to prototyping equipment or similar set-ups, at 6 hospitals in Sweden and serving all hospitals in their respective region. Makerspaces are attracting considerable attention in policy, business, education and research as a means to many different ends: increasing technical literacy, enabling rapid prototyping, supporting technical training, encouraging innovation by small businesses, etc. As such, we also see makerspaces set up in many different contexts across the world.

The particular makerspaces that VINNOVA organized had two objectives: (1) assist hospital clinicians in developing ideas for

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improvements in their hospitals and patient care; (2) assist commercial firms seeking to introduce new products into the hospitals. Both of these objectives can be read as an innovation policy intervention. The former, however, turned out to be specifically useful for supporting user innovation.

In this paper, we document the results of this intervention, focusing on the makerspaces first year of operations. Our assessment provides three main findings. First, 95% of the innovations developed by the clinical staff were intended primarily to make their own jobs more efficient, safer or better and were a response to a problem that the innovator faced on a daily basis her work. Overwhelmingly, on-the-job access to makerspaces thus appears supportive of *user innovation* (i.e. professional users, not end-users). Second, the makerspaces support the development of valuable innovations. Using a standard calculation applied in health economics and applying very conservative criteria in our calculations, we find that if the innovations developed in the makerspaces were implemented throughout the Swedish hospital system, they would in their first single year of use provide a return on investment on the order of 1400% to establish and operate the makerspaces for a three-year period (the duration of the intervention), even if we only examine the potential efficiency improvements of innovations and intentionally disregard quality of life improvements for patients and other possible benefits. Third, much of this potential is not realized because innovations do not diffuse very widely. This is the case because user innovators do not themselves want to pursue the commercialization of their innovations and because commercial firms do not recognize a market for them. As such, only a very limited share of the potential value was realized. However, an unexpected benefit of makerspaces is that they allow for small-scale production of innovations, thus partially overcoming this commercialization problem as hospitals self-produce solutions.

Based on these early findings, we propose that (at least in the hospital context) a policy of investments in supporting user innovation via makerspaces is economically and socially worthwhile. It makes clear that there are user innovations of high potential value at the intensive and extensive margin and that policy can lead to the realization of these innovations in the interest of social welfare. Unresolved problems do remain, but these are likely to be solvable through further supportive policy interventions. The under-diffusion of clinicians' innovations can be addressed by creating paths to large-scale production that are sensitive to the fact that innovators are users and take account of users' motives for innovating and (in some cases) very low incentives to commercialize. This might include increasing the capacity of makerspaces for self-production. The tendency for clinicians to innovate only for themselves (rather than for patients) can be addressed by also providing patients with access to similar makerspaces. Moreover, we propose that hospitals (at least in Sweden) be held more strongly accountable for integrating clinician-developed innovations – in times of increasing pressure on healthcare costs, failure to adopt innovations yielding productivity improvements of the magnitudes demonstrated here seems hard to defend.

2. Background: user innovation and innovation policy

In most countries, innovation policy is focused on supporting the innovativeness of firms (Arundel, 2007), not individuals. This can be done in numerous ways, such as e.g. subsidizing R&D, encouraging spillovers from university research, strengthening intellectual property rights, etc. all of which aim to increase the returns to R&D investment by firms. Focusing on firms as the primary source of innovation in the economy is, however, reflective of a producer-centric innovation

paradigm (Baldwin and von Hippel, 2011). This paradigm, which draws implicitly or explicitly on the seminal works on Schumpeter, assumes R&D to be a prerequisite for the introduction of new products and services and is foundational to most thinking about innovation and ideas production in the economy. Because of the paradigm, however, innovation policy often neglects other potential sources of innovation. One source of innovation frequently neglected by policy is users (von Hippel, 2017), i.e. individuals in the economy who use a specific service or product, either professionally or privately.

Given what we know today about the role of users in the innovation process, this omission seems unreasonable. After all, user innovation has been shown to be tremendously widespread and important in a range of areas. Classic studies demonstrated the dominant role of users in several industries, seminally von Hippel's (1976) study on the role of users in the development of scientific instruments and later several others (see De Jong, 2016 for an authoritative overview of the empirical scope of user innovation). In niche markets and developing industries, a great share of users are often engaged in innovation. This may be the case when users have extreme needs (Franke and Shah, 2003) or heterogeneous preferences (Lüthje et al., 2005), when producers have yet to recognize a market (Hienerth, 2006) or when producers simply do not consider a market worth pursuing (Hyysalo and Usenyuk, 2015). This last situation is commonly occurring, for instance, amongst patients with rare diseases who must by necessity innovate for themselves when firms do not (Oliveira et al., 2015). Recently, studies of representative samples of consumers in the UK (von Hippel et al., 2012), US and Japan (Ogawa and Pongtanalert, 2011), Canada (De Jong, 2013) and Finland (De Jong et al., 2015) have shown that between four and six percent of consumers innovate, primarily with the intention to use the new service or product. In the UK study, it was documented that the private investment by consumers in innovation was greater than the formal R&D expenditure of all UK firms.

A recent conceptual argument by Gambardella et al. (2015) further emphasizes why user innovation may benefit from policy support. While it has been recognized for some time that user innovation contributes to social welfare (e.g. Henkel and von Hippel, 2005), Gambardella et al. propose that policy interventions supporting producers, specifically R&D subsidies, encourage firms to pursue internal R&D at the expense of more open models of innovation, which lowers overall social welfare. By contrast, their model suggests that supporting users' innovation encourages firms to switch to user-augmented forms of innovation earlier than would otherwise be the case, which produces no reduction in welfare. This leaves unanswered the question of what a user-directed policy might be, however. The type of policy mechanisms used to influence the innovation of firms, clearly, are not appropriate: it is hard to subsidize consumer innovation, few consumer innovators are interested in protecting their innovations (making intellectual property rights likely to be ineffectual) and users innovating for themselves typically rely on knowledge that they already have available (meaning that search is limited and spillovers from science and research unlikely to produce great impacts).

Empirical research clearly speaks to the relevance of supporting user innovation through policy. Research has shown that many users 'drop out' of the innovation process before having realized a prototype and may be doing so too early for what is socially optimal, leaving potentially valuable ideas undeveloped. In a study of user innovation in healthcare in Finland, Kuusisto et al. (2013) found that while 27% of respondents had identified a problem within the preceding three years, only 8% had identified a solution (i.e. less than a third). Lüthje et al. (2005) found that only about half of mountain bikers with ideas for new or improved mountain biking equipment developed them beyond

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