An extensive empirical literature indicates that, even without formal intellectual property rights, innovators enjoy a variety of first-mover advantages and that ‘imitation’ is itself a costly activity. There is also accumulating evidence that an ‘open’ approach to knowledge production can deliver substantial efficiency advantages. This article introduces a formal framework incorporating all of these factors. We examine the relative performance of an ‘open’ versus a ‘closed’ (proprietary) regime, and explicitly characterise the circumstances in which an open approach, despite its effect on facilitating imitation, results in a higher level of innovation.

Keywords: Imitation; Innovation; Intellectual Property; Openness; Open Source

INTRODUCTION

The last decade or so have seen an explosion in the level of ‘open’ information production not only in traditional areas such as software (e.g. Linux, Firefox) but also in areas ranging from online encyclopaedias (Wikipedia) to genomic databases (the Human Genome Project). Such developments suggest that, at least in some important cases, open models of knowledge production can do as, or even better, than closed ones. As we discuss further below, this is somewhat surprising and it is important to investigate carefully how and why this could be the case.

It is important to note here that we are focused on the rate of innovation and not the level of welfare. After all it is well-accepted that being more ‘open’ (having weaker intellectual property rights) can improve welfare by improving access. But this is certainly not the case in relation to innovation. In fact most of the traditional literature on innovation would support, implicitly or explicitly, reasoning along the following lines: the level of innovation is a function of the value that innovators (that is the original creators of a work or invention) obtain, $V$, and the cost they incur, $F$. Furthermore, it is clear that the level (or likelihood) of innovation is increasing in the value and decreasing in cost. Label the closed and open regimes by $C$ and $O$ respectively then it is usual to assume that the proprietary regime results in higher returns than in the open one: $V^P > V^O$, while costs are unchanged: $F^P = F^O$. This necessarily implies that innovation must be higher...
in the proprietary regime than in the open one. Furthermore, suppose imitation has cost \( F_{\text{IMM}} \) but is ‘fast’.\(^4\) Then, simple competitive free entry arguments would suggest that the common returns (common because imitation is fast) must be driven down to costs so the innovator receives \( V = F_{\text{IMM}} \). Since an innovator must cover her costs innovation can only occur if imitation is at least as costly as innovation: \( F_{\text{IMM}} \leq F \). But, at least in the open case, imitation is certain to be cheaper than innovation and hence no innovation will occur!

This brief sketch of the standard approach already indicates why the level of ‘open’ production is rather surprising. It also points us to where we must look if we are to explain the success, or simply survival, of open approaches: either we can examine costs \( F() \) or income/value \( V \). At this point it is worth recalling that repeated surveys, such as Levin et al. (1987), Mansfield (1985), Cohen et al. (2000), and Arundel (2001), show that firms appropriate returns from innovation using a variety of methods other than exclusive rights (IP) such as secrecy, lead time, marketing and sales, learning curve advantages. Not only does this indicate that there are a variety of first-mover advantage for an innovator, but this work also shows that imitation is a costly process both in terms of time and money even when no exclusive rights are used (or available).

Of course, the major alternative to IP is often secrecy. In the case of ‘open’ (‘open source’) knowledge production both secrecy and the traditional exclusivity of IP are foregone. Nevertheless, even in this case, imitation costs and first-mover advantage will still exist -- though perhaps much reduced in size.

This article takes this empirical evidence ‘seriously’ and we explicitly model imitation as costly (though still as cheaper than innovation usually) and the innovator as having some form of first-mover advantage. Our framework provides a simple, and novel, way to conceptualize ‘innovation’ space, which allows one to compare innovation under a proprietary and an ‘open-source’ regime in a straightforward and intuitive manner. We show that, even in the baseline case where ‘open-sourcing’ simply reduces imitation (copying) costs, some innovation will still take place under the open-source regime – albeit substantially less than in the proprietary case. The crucial point here is that, at low innovation costs, ‘allowable’ imitation costs (that is imitation costs that still result in the innovation being made) can be even lower. Thus, even for large large reductions in the cost of imitation some innovations remain feasible.

Our next step is to consider the possibility that an ‘open’ approach reduces both innovation and imitation costs. A variety of authors (e.g. Lakhani and von Hippel (2003); Bessen (2006)) have pointed out that an ‘open-source’ approach may offer substantial efficiency advantages – for example by allowing users to participate directly in adding features and fixing ‘bugs’ – and this is particularly true where the information good is complex and (hence) transaction costs are high. While the initial arguments in favour of the efficiency of open approaches were based on anecdotal or case study evidence, recent empirical work on a larger scale, such as Koch (2008), have provided strong empirical support for his view. Thus, we explicitly model the move to ‘open-source’ as resulting in a simultaneous reduction in both innovation and imitation cost. This clearly makes an open approach more attractive. However, the real question is not whether it is more attractive but to what extent this is so. After all the outcome under an open regime may still be (far) inferior to that under a closed one. Here, we are able to analyse the effect of a change of regime within a single overarching, but simple, framework. Using it, we can compare, clearly, and formally, different assumptions about what going ‘open’ entails, and derive specific (sufficient) conditions under which a move to an open regime results in an increase in innovation.

THE MODEL

There is some information good, the ‘innovation’,\(^5\) which can be created at fixed cost \( F_i \) – the innovation cost. Once created, it may be
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