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Contests as innovation policy instruments: Lessons from the US federal agencies' experience

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ABSTRACT

An increase of the innovation contests and their associated prizes have been observed since the 90s especially in the US through the sponsorship of the American Federal Agencies. The purpose of this article is to shed light on some of the direct and indirect effects of US federal agency contests not only on economic dynamics but also on social dynamics. Based on recent case studies, this paper describes the various positive impacts that federal agency contests may have: i) contests may display a strong incentive effect ex-ante and during the contest; ii) they may produce favourable spillovers after the contests, at innovation and economic levels in specified economic/industry sectors and iii) they may also play a beneficial social role, contributing to citizens' education and awareness. Nevertheless, as a contest remains a sophisticated device, public decision makers must comply with certain requirements if they wish to benefit from this particular policy tool in order to spur innovation.

1. Introduction

Prizes or contests are among the oldest incentive measures used to spur innovation (Scotchmer, 2006). Although their popularity decreased in the 18th century, renewed interest in them has been observed from the 1980s onwards in a movement largely initiated and carried out by the United States (see Crosland and Galvez, 1989; Hanson, 1998). Contests awarding incentives have returned to the spotlight along with the emergence of major projects, leading Adler (2011) to talk of the renaissance of contests and prize-awarding systems. Based on a study analysing around 200 international contests, a report by McKinsey (2009) pointed out that during the 2000s, there was a steep rise in 'Grand Challenges' with 60 new projects awarding around US\$250 million. This movement initially emerged on private platforms (Innocentive, NineSigma, etc.) and via philanthropic organizations, rapidly reaching the heights of US Federal Agencies at the beginning of the 2000s. By June 2017, more than 760 competitions had been launched by over 100 federal agencies and departments via a dedicated Internet platform, challenge.gov, created in 2010 (OST, Office of Science and Technology, 2016). Over the last two decades, the sharp rise in publicly-funded contests in the US (i.e. launched by federal agencies) has born witness to this growing enthusiasm (Deloitte, 2014).

Our article focuses on innovation contests or prizes. These tools consist of a private and/or public sponsor launching a challenge based on an idea, study or invention, and usually rewarding the winner(s)

with a monetary prize (Gallini and Scotchmer, 2002; Bullinger and Moeslein, 2010). We consider innovation, following partly Edquist and Zabala-Iturriagoitia (2012) as new creations mainly carried out by companies: new products (goods or intangible services), new processes (technological or organisational). But, as regards contest, the scope of innovation is enlarged and includes innovations also carried out by citizens and individuals, and innovations as societal solutions contributing to change citizen behaviours. In this view, contests appear both the vector of new concrete products and the catalysts for future innovation. A distinction, now widely shared in studies, is made between "recognition prizes" and "inducement prizes" (Scotchmer, 2006; Morgan, 2008; Adler, 2011). The former offer ex post recognition to major research efforts over an extended period (e.g. the Nobel Prize). The latter generally initiate research or innovative processes related to a specific issue by stimulating potential candidates with a prize established by a sponsor ex ante (Gallini and Scotchmer, 2002).

Although a great number of studies has been published in both managerial and economic literature investigating innovation contests (for a recent review, see Adamczyk et al., 2012), the study of innovation contests as policy tools has recently emerged. Yet, contributions do not fully cover all the relevant issues. On the one hand recent studies have essentially focused on the effective /optimal contest design for public actors (Besharov and Williams, 2012; Kay, 2012; Berstein and Murray, 2015). On the other, policy discussions on innovation inducement prizes converge on boosting the development of a new technology, but

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do not take into account the ex post impact of such policy instruments (Besharov and Williams, 2012). As the number of contests funded by public actors such as US federal agencies continues to increase, there is an urgent need to begin assessing the impacts of such contests on economic dynamics, following on from Schumpeter's contributions. Until now, little attention has been paid whether to assess the success or failure of innovation inducement prizes, therefore empirical evaluation appears as crucial.

The purpose of this article is to spell out some of the direct and indirect effects of US federal agency contests not only on economic dynamics but also on social dynamics, taking into account the fact that many contests launched by US federal agencies have societal goals (Desouza and Mergel, 2013). Despite the lack of a counterfactual conditional to compare worlds with and without contests, our aim is to examine the observed effects of several US federal agency contests using recent case studies analysed in depth by certain academics, as well as illustrations found in various academic and administrative reports. Our aim is not to propose an exhaustive assessment of the federal agencies' outcomes, but rather to explore the first feedbacks, which may be useful to public authorities wishing to use contests as policy instruments.

Based on recent case studies, academic literature's and history's contributions, this research describes the various positive impacts that federal agency contests may have: i) contests may display a strong incentive effect ex-ante and during the contest; ii) they may produce favourable spillovers after the contests, at innovation and economic levels in specified economic/industry sectors and iii) they may also play a beneficial social role, contributing to citizens' education and awareness.

Moreover, our point is that the potential positive effects of public federal contests are intrinsically linked to the particular contest design chosen and to its ability to change and adjust during the contest period if required. Under these conditions and for pre-defined goals, using innovation contests as political tools may prove to be effective and generate feedback. Our results contribute to extend the recent innovation policy's literature regarding the choice of effective policy instruments (Autio et al., 2014, Edler and Fagerberg, 2017). More precisely this study contributes to enhance the strand of the literature dedicated to the demand side policy and mission-oriented innovation.

In the following section, we will examine the theoretical background associated with innovation contests, including the management and economic contributions as well as the policy innovation literature. The third section, after focusing on the flexibility of contests design, will review the historical and institutional context of the emergence of US federal agencies' innovation contests over recent decades. In the fourth section relying on empirical evidence, we will expound the various positive impacts that may be generated by innovation contests launched by federal agencies. The fifth section will focus on the article's contribution to the innovation's policy literature and propose new directions for public actions in the area of innovation's support. The last section will stand for the conclusion.

2. Theoretical background

As management studies are interested in the managerial dimension of the innovation process, one could think that economic studies are, a priori, more appropriate to study the real impact of innovation contests, through an innovation policy perspective. Nevertheless, the issue of contests/performances on innovation processes has often been addressed using theoretical models that are aimed to compare the contests' performances with other inducement innovation tools such as patents and grants. We will first underline the limits of these standard economic approaches and explain the lessons learned from the history. Second, the place of contests in the innovation policy literature will be evoked.

2.1. Contests: management, economy and findings

Management studies generally focus on the innovation contests' managerial aspects such as the participants' integration, the co-creation process, the users' motivations, the underlying platform design, etc. In addition, the "Internet-based" dimension of the contests is at the heart of the issues raised (Piller and Walcher, 2006; Ebner et al., 2009). In parallel, the economic perspective addresses theoretical models of innovation contests, which are often designed as competitive games (see Fullerton and McAfee, 1999). The issues examined include the duration, the number of solvers and the determination of the appropriate amount of the award (Adamczyk et al., 2012). Most of the time, the main objective of these models has been to compare the contests' performances with other inducement innovation tools such as patents and grants (Wright, 1983; De Laat, 1997; Gök, 2013; Shavell and Van Ypersele, 2001; Clancy and Moshini, 2013; Maurer and Scotchmer, 2004; Brennan et al., 2012; Penin, 2005; Kremer, 1998). But, finally, none of these models reaches a definitive conclusion regarding the superior effectiveness of prize or patent. Furthermore, this literature presents some limitations.

One major limitation of those models is based on the hypothesis that the two systems (patents and contests) are opposed and cannot be complementary. As Adler suggest (2011), "*The two need not be mutually exclusive. On the contrary, prizes and patent protection can be complementary. While patent protection provides a background inducement for all commercially marketable innovations, prizes augment the reward for types of innovations that have been identified ex ante as having particular social value*" (p. 15). Moreover, contests are considered in a very simple way in the standard economic approach, unlike the complex institutional nature of the contest (Kremer and Williams 2009, Williams 2012).¹ These approaches do not allow a sufficient understanding of the logic behind public authorities' more recent use of contests, particularly because they consider patents and contests as formally equivalent (Brennan et al., 2012). In other words, the wide variety of contests that agencies propose cannot be understood using the classic framework of analysis (Liotard and Revest, 2016). As we will see later, some innovation contests are launched even when agencies have no information about the costs and value of the innovation. Others are characterized by their association with technological and societal objectives and, as a result, are extremely difficult to evaluate ex ante. One final contest category is characterized by an absence of monetary prizes, taking instead a societal approach.

Lastly, one might wonder whether the recent approach using field experiments will overcome the initial limitations -or some- aforementioned (Besharov and Williams, 2012). On the one hand, through construction, randomised field experiments can provide a reliable counterfactual analysis. On the other, some conclusions were drawn from case studies and revealed opposite viewpoints regarding the effect of contests on the process of innovation.²

One can finally agree that economic models or experiments cannot replace historical approaches and/or case studies because these enable us to latch both on the complexity and the richness of innovation contests, and better understand their recent use by US federal agencies. Historical studies of large-scale programs (Bruno et al., 2012; Nicholas, 2013; Moser and Nicholas 2013; Moser 2013) have addressed the issue of the impact of real contests on the innovation process and economic dynamics. More precisely, such research has highlighted the consistent

¹ See, for instance, Gök (2013) "This theoretical discussion has generally been helpful in understanding the efficiency of prizes, although it relies on many assumptions and frames prizes in a very simplistic sense" (p. 8).

² In the field of experimental economy, based on case studies, some conclusions reveal opposite viewpoints regarding the effect of contests on the process of innovation. While Boudreau and Lakhani (2011) underline the positive effects of the TopCoder experiment, other studies offer a more pessimistic view on the use of contests (Bruggemann and Meub, 2015).

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