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# How do firms perceive policy rationales behind the variety of instruments supporting collaborative R&D? Lessons from the European Framework Programs

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ABSTRACT

The main objective of the paper is to analyze to which extent participation in public programs supporting collaborative R&D meets the goals pursued by policy makers when setting up such instruments. Theoretically, these policy instruments are designed to overcome a set of failures (market and systemic failures) impeding the innovation process. We use as an example in the empirical part the European Framework Programs (FP) 5 and 6, which include a large and representative range of instruments. Each of these FP instruments is characterized according to the set of failures it is supposed to solve, its objectives and characteristics, and we discuss how these aspects are perceived and exploited by participating companies. Using data collected in the Innoimpact survey, involving thousands of FP5 and FP6 project participants, we compare the motivations of firms in choosing these instruments with our theoretical predictions. We find that the motivation to participate in a FP project does not differ greatly from one instrument to the other and the characteristics of the projects do not exhibit major differences. The paper concludes with some policy recommendations.



## 1. Introduction

This paper analyzes the extent to which participation in publicly supported collaborative R&D programs meets the goals of policy makers when setting up instruments for running such programs. Theoretically, these policy instruments aim at overcoming a set of failures that impede the innovation process. The variety of instruments reflects the intentions of policy makers to resolve a set of problems faced by economic actors active in different sectors and innovation systems. These failures evolve over time suggesting that policy makers require a good understanding of the economic and social environment, and the changes that occur within it. If policy instruments are designed appropriately, then the responses of participants in terms of motivations and projects characteristics should be coherent with the set of failures and policy objectives being targeted by policy makers.

In this paper, we thus discuss the extent to which there is a fit between the failures targeted by the diverse instruments and their objectives as they are set by the policy makers on the one hand, and, on the other hand, the motivations of the companies for using such instruments and the characteristics of their project proposals. This approach is a first originality of the paper, which tries to build a bridge between different types of analysis that are usually conducted separately, about:

(i) the rationales behind instruments taken separately (Steinmueller, 2010; Lundvall and Borrás, 2005),
(ii) the rationales behind combinations of instruments in a "policy-mix" (Flanagan et al., 2011; Magro and Wilson, 2013),
(iii) the firms' opinion on the relevance of specific policies (as part of usual "customer satisfaction" enquiries run by public program managers) and
(iv) the firms' evaluation of the barriers to innovation which mitigation or removal should be targeted by policies (Hölzl and Janger, 2012).

We use the example of the European Framework Programs for Research and Technological Development (FP hereafter), which provide a large and representative sample of the variety of instruments policy makers may set up. More precisely, we focus on the main FP5 and FP6 instruments, which have the following generic characteristics: (i) direct funding of R&D projects, proposals for projects and/or activities related to the dissemination of research results; (ii) promotion of cooperation among actors; and (iii) involvement of public and/or private actors in the research. We do not consider mobility grants in our analysis. These programs are large in terms of budget, number of

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actors involved and they foster international collaboration. In addition, some of the FP5 and FP6 instruments are very similar to the "traditional ones" that were created for the first FP back in the 1980s and are still in operation, while others were first designed for FP5 and maintained in FP6 and FP7. FP5 and FP6 instruments can thus be considered as illustrative of the almost 30 years history of FP instruments implementation (Rossi, 2007; Corvers et al., 2007) as well as, more broadly, of the main instruments set up in the last decades of public support to collaborative R&D (Steinmueller, 2010; Lundvall and Borrás, 2005).

We develop our analytical framework based on the economic literature considering both market and systemic failures to justify the above mentioned set of policy instruments (Bach and Matt, 2005; Aghion et al., 2009). These two sets of failures are based on different theoretical frameworks with distinct conceptions of the innovation process and of the reasons that might block it. A second originality of the work is that we deliberately take into account the two approaches separately and consider them as complementary in terms of theoretical explanatory content. Thus, we depart from other contributions that revisit and integrate market failure arguments in a more global systemic approach (Weber and Rohracher, 2012; Bleda and del Rio, 2013). Another reason for our choice is that, in practice, the policy debate and design, even if increasingly informed by the systemic view of innovation, still relies on market failure arguments when designing the instruments (Dodgson et al., 2011). The paper is an attempt to reconcile two theoretical approaches, often opposed by authors (Nelson, 2009; Chaminade and Edquist, 2010), to be able to analyze effective policy practice in all its dimensions. Using a unique theoretical lens for empirical analysis would be too restrictive. Based on a comprehensive set of failures (market and systemic) to justify R&D collaborative instruments, we derive a micro-analytical grid relating failures with a complete set of policy objectives applicable to empirical research.

The third originality of our work is based on the uniqueness of the data collected about the projects proposed by firms and their motivation to participate to specific instruments of FP 5 and 6. We were able to link the objectives of firms and the political objectives of instruments to analyze their compatibility. To the best of our knowledge, analyzing the design of policy instruments and the perception by firms is a rather unusual way of evaluating policies. This micro-analytical approach allows informing the practice of funding R&D projects and what the variety of instruments developed in FPs brings to participants. We question whether the diversity of instruments makes sense to companies and show that developing too complex instruments might be counterproductive as participants do not perceive their differences.

Section 2 analyzes the economic rationale behind innovation policies and the set of failures the policy instruments are supposed to overcome. According to two main strands in the literature we distinguish between market and systemic failures and try to include them in a common framework. Section 3 applies these theoretical developments to a description of the main FP5 and FP6 policy instruments by differentiating each of them according to the set of failures they are supposed to solve, their subsequent objectives, and their characteristics. We discuss whether, in theory, this differentiation may be clearly perceived and exploited by participating companies. In Section 4 we use the data collected via the Innoimpact survey (Fisher et al., 2009), which was administered to thousands of participants in FP5 and FP6 projects. We compare the motivations of firms for choosing the selected instruments with our theoretical predictions. Section 5 provides some policy recommendations.

## 2. Conceptual framework: the failures behind policy rationale

From a theoretical point of view, State intervention in the domain of science, technology and innovation (STI) is justified by the existence of failures in the innovation process and system and the hope that they can be overcome through the application of different instruments. We build our conceptual framework on the literature considering both market and systemic failures rationales to innovation policies (Bach and Matt, 2005; Aghion et al., 2009; Woolthuis et al., 2005; Dodgson et al., 2011; Box, 2009; Weber and Rohracher, 2012). Identification of these failures depends very much on the model of innovation and thus the theoretical framework being considered. The presence of market failure reduces incentives for private investment in innovation, precluding investments from reaching socially optimal levels (Arrow, 1962; Nelson, 1959). Additional arguments based on theoretical advances underlining the systemic and complex nature of the innovation process point to systemic failures that block the functioning of innovation systems and reduce the overall efficiency of R&D efforts (Malerba, 1996; Woolthuis et al., 2005). The instruments (direct funding of R&D cooperative projects) we consider in this paper might be justified with complementary arguments derived by the two approaches. Using a broad analytical framework will thus allow to incorporate a comprehensive set of policy objectives used in practice. If policy design has increasingly been informed by systemic and complex innovation approaches, market failures type of thinking remains a prevalent viewpoint in current policy interventions (Dodgson et al., 2011).

Our aim is to develop an analytical framework derived from general theoretical arguments developed in the literature and make it operational to analyze our illustrative case of European FP 5 and FP6 instruments. Highlighting the failures identified in the market and systemic failure approaches, allows justifying the selected policy instruments and their corresponding objectives with a broad set of arguments. We define theoretically the policy objectives at the level of each specific instrument and not at a more general macro level (such as increasing European competition, creating jobs, increasing economic cohesion). The main result and contribution of this part is to develop a micro-analytical grid linking failures to an exhaustive set of policy objectives defined at the policy instrument level. The advantage of this grid is to be grounded in theory and applicable in empirical analysis of effective policy practice. It also aims at being compatible with objectives of participating firms in order to assess how participants perceive the various policy rationales behind each instrument.

### 2.1. Market failures

In line with "input/output" reasoning, innovative activity is performed by an innovator using inputs to produce technology, regarded as information. The argument proposed by Arrow (1962) and Nelson (1959) roughly holds that the peculiar activity of innovation and the good that results do not show properties "adequate" for the standard social welfare optimization. There are indivisibilities in both inputs and outputs; outputs are uncertain and may take a long time to realize and, being non-rival and non-excludable goods, they are non-appropriable.

The result is the well-known "lack of incentive" to innovate. The activity is costly, mostly because of its characteristics of indivisibility. It is also risky, because of the uncertainty related, on the one side, to the final outcome and, on the other side, to the level of demand resulting from the problem of price determination (according to the so-called "paradox of information", the buyer does not know the value of the information unless he buys it). Moreover, the economic gains are difficult to appropriate since they may benefit (Steinmueller, 2010): (i) consumers or clients, who have access to better products without necessarily being charged a correspondingly increased price; this is the basis of consumer surplus and "market" externalities; (ii) competitors and the rest of the economy who can use the technology produced by the innovator without paying anything, giving rise to "knowledge" and "network" externalities. In other words, although