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Innovation intermediaries and performance-based incentives: a case study of regional innovation poles

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Abstract

A growing number of innovation policies rely on publicly-funded innovation intermediaries to provide knowledge-intensive services to firms, particularly small- and medium-sized ones. The performance of innovation intermediaries is often assessed using indicators that need to be closely aligned with policy objectives to be effective. However, this alignment is difficult to achieve and is often overlooked in practice. We analyse the relationship between performance indicators and the behaviour of intermediaries by examining a case study of innovation intermediaries funded with public resources in Tuscany, Italy. The intermediaries implemented actions that allowed them to achieve their performance targets rapidly. However, due to a misalignment between indicators and policy objectives, these actions were not entirely consistent with the latter. After reviewing the literature on this key issue, we build on our findings to suggest how to design performance indicators that can induce intermediaries to more effectively support the achievement of policy objectives.

Key words: performance-based funding; innovation policy; innovation intermediaries; innovation poles

1. Introduction

Intermediary organisations that support firm-level and collaborative innovation—often called knowledge or innovation intermediaries (henceforth: intermediaries)—have gained increasing prominence in knowledge-intensive economies (Howells 2006; Lazaric et al. 2008; Meyer and Kearnes 2013; Schlierf and Meyer 2013). These organisations provide knowledge-intensive services, including support to university–industry collaborations, knowledge and technology mapping, technical assistance in research and development (R&D) projects, and the dissemination and commercialisation of research results (Bessant and Rush 1995; Lynn et al. 1996; Hargadon and Sutton 1997; Den Hertog 2000; Howells 2006; Wright et al. 2008; Doganova 2013; Kearnes 2013; Wagner et al. 2014). Although typical intermediaries include knowledge-intensive business services providers, technopoles, technology transfer agencies, science parks, and incubators, a wide range of organisations can perform at least some intermediary functions (Howells 2006; Caloffi et al. 2015).

A growing number of policies worldwide rely on intermediaries to support R&D, innovation, and technology transfer (Uotila et al. 2012; Meyer and Kearnes 2013; Fiordelmondo et al. 2014; Knockaert et al. 2014). In many cases, these intermediaries receive public funds to provide knowledge-intensive services to firms in order to boost their innovation capabilities. Often, intermediaries are specifically given the responsibility of working with small- and medium-sized enterprises (SMEs), which are less likely than large firms to carry out R&D activities systematically and are, therefore, often less innovative and fall prey more easily to cognitive lock-ins (Laranja et al. 2008).

Policymakers often define performance targets for publicly-funded intermediaries in order to induce them to act in accordance with policy objectives. The public policy literature has discussed how the setting of performance targets and the design of performance indicators to measure their attainment affect the behaviour of the assessed actors, particularly when public funding is made conditional on performance (Fitz-Gibbon 1990; Langford et al. 2006; Compagni and Tediosi 2012; Teixeira and Koryakina 2013). However, little evidence exists about how performance targets are designed in the particular case of intermediaries or their effectiveness in aligning intermediaries' behaviour with policy objectives. The case of publicly-funded intermediaries is peculiar because of the tension between the policymakers' need to set performance targets—

and related indicators to measure their achievement—that are simple, clear, and achievable within a relatively short time and the difficulty in measuring the actual performance of intermediation activities, whose effects are often invisible and ineffable (Klerkx and Leeuwis 2009; Schlierf and Meyer 2013) and may require a long time to manifest.

We illustrate this problem and identify possible solutions based on a case study of a set of innovation intermediaries in the Italian region of Tuscany that were funded by the regional government between 2011 and 2014. We argue that the intermediaries' performance was evaluated by means of indicators that were misaligned with the policy's ultimate objectives. Consequently, the intermediaries adopted behaviours that, while allowing them to rapidly achieve their performance targets, did not fully support these objectives. We build on these findings to suggest how to design alternative performance indicators that can be used to induce intermediaries to more effectively support the achievement of policy objectives.

The implications of these findings are relevant beyond the specific case of Tuscany. First, the set-up of the policy intervention that we studied is not unique: Not only have other Italian regions used similar indicators to evaluate the performance of innovation intermediaries, but some of these indicators are also among the most commonly used by policymakers around the world (Comacchio and Bonesso 2012). Secondly, the misalignment between performance indicators and policy objectives is a problem for many innovation policies, inspired by an evolutionary approach that aims to improve the learning and cognitive capacities of firms and other actors (Laranja et al. 2008). Although researchers look for appropriate methodologies for the *ex post* evaluation of these policies, policymakers often identify *ex ante* indicators that do not capture the intended effects of the programmes (European Commission 2013). Our proposed approach to designing effective performance indicators can, therefore, be applied to a broad array of policies.

This article is structured as follows. In Section 2, we review the literature on publicly-funded innovation intermediaries and on the indicators used to measure their performance, and we identify the main obstacles to devising indicators that are aligned with policy objectives. Section 3 presents the main characteristics of Tuscany's policy programme supporting innovation intermediaries, as well as our data sources. Section 4 explores the effects of the indicators implemented in this programme on the intermediaries' behaviour. Section 5 discusses how to better align performance indicators for innovation intermediaries with policy objectives. Section 6 concludes the article.

2. Key challenges in setting performance-based incentives for publicly-funded innovation intermediaries

In recent years, numerous national and regional governments have funded innovation intermediaries with the objective to support innovation and technology transfer processes (Uotila et al. 2012; Meyer and Kearnes 2013; Fiordelmondo et al. 2014; Knockaert et al. 2014). These publicly-funded intermediaries are expected to improve the resources (information and networks) and capabilities (competences and skills) of the economic actors in their national or regional innovation systems, thus leading them to change their innovative behaviours and achieve better innovation performance (Metcalfe 1995; Lambooy and Boschma 2001; Smits and Kuhlmann 2004; Lundvall and Borrás 2005; Laranja et al. 2008; Dodgson et al. 2011). Intermediaries can support other economic actors, particularly firms, through a range of activities. They can boost firms' innovation capabilities by providing training (e.g. in the use of specific technologies) or support services (e.g. support with patent search) or by intermediating the provision of services that complement their competencies (Bessant and Rush 1995; Vonortas 2002). The intermediaries' support is particularly important for SMEs, which often lack the ability to acquire useful knowledge, competencies, or technologies and implement them into products and services (Belitz and Lejpras 2016). More fundamentally, some firms may even be unaware of what knowledge, competencies, or technologies they are lacking (Brusco 1992; Kaufmann and Tödtling 2002). Through activities such as knowledge and technology mapping, intermediaries can help firms to gain awareness of what they need in order to find the most appropriate ways to obtain it.

Intermediaries can also stimulate productive interactions and collaborative innovation by creating connections between people in different organisations; they can do so through focused networking activities, such as targeted introductions and meetings, as well as through the provision of interaction spaces (Etzkowitz and Leydesdorff 1998; Acworth 2008; Kodama 2008; Rossi et al. 2010). This can be particularly helpful to newly created firms and SMEs, which are usually less open to external collaborations than other organisations (Rothwell and Dodgson 1991).

Policies that rely on the public funding of innovation intermediaries usually target one or more of the generic objectives that were briefly outlined above. To induce innovation intermediaries to pursue the policies' intended objectives, the allocation of public funding is often conditional on the achievement of performance targets. However, for performance-based incentives to be effective, it is important for performance indicators to be closely aligned with policy objectives. The available evidence suggests that this is not often the case. Studies of policy implementation have shown that performance indicators are usually designed heuristically, often based on past experience, rather than grounded theoretically (Sizer 1979; Jesson and Mayston 1990; Curristine 2006; Molas-Gallart and Davies 2006). Heuristic approaches can result in indicators that focus only on a few activities, or on relatively unimportant ones, just because they are easier to measure (Robichau and Lynn 2009; Rossi and Rosli 2015). Such indicators are often ineffective not only because they provide a biased evaluation of performance but also because they create an implicit incentive system that alters the behaviour of the assessed units (Langford et al. 2006; Compagni and Tediosi 2012; Teixeira and Koryakina 2013) in ways that can be misaligned with policy objectives (European Commission 2013). This is because the assessed units are incentivised to adopt strategies that, without necessarily being opportunistic, help them to comply with the indicators rather than with the ultimate goal of the policies.

There is ample evidence of the interplay between performance indicators and organisational behaviour. For example, Gulbrandsen and Rasmussen (2012) showed how, in the case of the Forny technology transfer programme in Norway, using the number of spinoff companies as a performance indicator in order to allocate funding to technology transfer offices led these offices to launch too many spinoff firms at a stage of development that was too early, thereby resulting in a high rate of business failure. In Australia, the allocation of research funding to universities based on the number of publications led many institutions to publish as much as possible without regard for the quality of the publication outlets (Schneider et al. 2016).

The misalignment between performance indicators and policy objectives can arise because of some limitations inherent in performance measurement, which is a problem that is particularly evident in

the case of innovation intermediaries. First, because the ease of performance measurement can vary across different activities, policymakers often design indicators that focus only on those activities that can be measured and disregard other activities that are not as easily measured but that may be equally or even more important. As a consequence, publicly-funded organisations are likely to invest effort only in those activities that allow them to achieve good performance scores in the indicators (Davies 1999). Secondly, for practical reasons, the information used to build performance indicators is usually collected over a relatively short period. As a consequence, publicly-funded organisations prioritise activities that produce immediate outputs, which can be counted for performance measurement, and neglect activities that would yield results only over a longer time horizon than that considered by evaluators.

Finally, performance indicators are often defined in terms of the production of specific and easily quantifiable *outputs* that are considered desirable in themselves (Comacchio and Bonesso 2012). Instead, policy objectives usually relate with more complex and less quantifiable *outcomes* that should be achieved by targeted actors. Recently, numerous criticisms of output indicators have led to greater emphasis on the use of outcome indicators (or results indicators), also in the evaluation of regional policy (European Commission 2014). However, the definition of outcome indicators *per se* does not guarantee the setting of appropriate behavioural incentives, unless these outcome indicators are aligned with policy objectives.

In the case of innovation intermediaries, policy-relevant outcomes typically involve actors in the innovation system achieving specific benefits, thanks to the intermediaries' activities, such as firms' improvement in terms of innovation capabilities, improvement in economic performance, and acquisition of new skills. Because they involve intangible processes of learning and capability development and concern different actors from those whose performance is evaluated, these outcomes are often difficult to quantify, and they may take a long time to be realised. As a consequence, policymakers are particularly likely to steer away from measuring such outcomes.

The misalignment between indicators and policy objectives can also arise for other, more political reasons than merely difficulties in performance measurement. Policymakers might set simple indicators because their real goal, beyond their official statements, is not to select the best and brightest, but to eliminate the worst. Policymakers could also avoid setting complex indicators and ambitious targets because they do not want the funded organisations, which are also part of their electorate, to fail to achieve their performance expectations. This is more likely to occur in regions in which the distance between policymakers and their voters is relatively short. Sometimes, policymakers intentionally conflate indicators with policy objectives. When policy objectives are complex or even conflicting, it is easier to find agreement regarding symbolic measures of performance that appear objective and uncontroversial (Matland 1995; Molas-Gallart and Castro-Martinez 2007), rather than engage in fundamental discussions about the underlying aims of policy. In these cases, policymakers may encourage the pursuit of simple indicators for their own sake (Langford et al. 2006), leading to an overlap between indicators and policy objectives ('proxies becoming goals', in the words of Langford et al. 2006).

Through our case study of publicly-funded innovation intermediaries in the Italian region of Tuscany from 2011 to 2014, we show that the indicators used to measure the intermediaries' attainment of their performance targets suffered from some of the limitations outlined above. They were misaligned with policy objectives, and they, consequently, induced intermediaries to behave in ways that did not serve the latter. Building on these findings, we discuss how indicators should have been designed to more effectively facilitate the achievement of policy objectives, and we derive some general implications for policy design.

3. Tuscany's innovation poles programme

3.1 The policy's objectives within the broader policy context

In 2010, the regional government of Tuscany in Italy identified a set of key technologies/applications and launched a call for tender, inviting organisations to submit proposals for the creation of innovation poles in such technology areas for a three-year period (2011–14). Innovation poles, which are a particular type of innovation intermediary, were consortia among different organisations based in the region—universities and research centres, knowledge-intensive service providers, and firms. Such poles received some public funds to provide knowledge-intensive services to the firms of the region, particularly to SMEs and weaker firms. In particular, the main functions of the poles and the key objectives of the policy interventions were explicitly listed in one of the documents prepared by the regional government (Regione Toscana 2010):

1. To promote and meet the demand for innovation on the part of local firms, particularly SMEs and weaker firms, which were not able to express such a demand;
2. To expand the number of firms accessing high value-added knowledge-intensive services in order to promote the diffusion of innovation across pole members and with external firms;
3. To help firms gain access to scientific and technological knowledge and to networks and resources at both national and international levels; and
4. To support the sharing of equipment and of research, development, testing, and certification labs.

Each consortium was led by a managing organisation, which, according to the regional law, should be either a publicly owned innovation centre (business development service centre or the like) or an association between one or more innovation centres, universities, or research centres and, eventually, private firms. The members of the managing organisation should have been located in the region. The consortium decided what services the pole would provide and how its many other activities would be organised.

The key technologies/applications identified by the regional government, in which the poles were specialised, are those in which the region has long-hosted traditional industrial districts or innovative clusters of firms. In recent years, the number of these firms has reduced drastically because of both the crisis and the changes in market demand and global competition. Especially with regard to traditional made in Italy productions (e.g. fashion and furniture), in which many regional firms are specialised, the products that remain (and may remain) competitive are high-end products, for which innovation in its various forms is fundamental (Belussi and De Propris 2013; Bellandi and De Propris 2015). Through the creation of innovation poles, the regional government wished to stimulate the emergence of a new kind of intermediary that could support the upgrading and the innovative capacity of firms in the region, particularly those SMEs that had little understanding of their needs and were unable to express a demand for innovation.

Table 1. Key technologies/applications, consortium participants, pole members.

Innovation pole (acronym)	Key technologies/applications	Number of organisations in the consortium	Number of member firms as of 30 June 2011	Number of member firms as of 30 June 2014
OPTOSCANA	Optoelectronics for manufacturing and aerospace	2	67	92
INNOPAPER	Paper	1	89	139
OTIR 2020	Fashion (textiles, apparel, leather, shoes, and jewellery)	7	223	501
VITA	Life science	8	41	158
PIETRE	Marble	4	52	122
PENTA	Shipbuilding and maritime technology	5	225	352
POLIS	Technologies for sustainable cities	8	228	643
NANOXM	Nanotechnologies	6	70	128
CENTO	Furniture and interior design	6	177	322
PIERRE	Renewable energies and energy saving technology	13	120	368
POLO12	Mechanics, particularly for automotive and transport	6	198	390
POLITER	Information and Communication Technologies and robotics	13	195	697

The region already hosted a network of intermediaries that provided services to SMEs. They were mostly public or public–private innovation centres that often specialised in a particular sector or technology. However, only some of them offered knowledge-intensive services, whereas others provided more traditional services. Moreover, most of them had few relationships with important sources of knowledge, such as universities and research centres. According to the policymaker's objectives, the poles should be a new type of innovation intermediary, having both the applied knowledge of the previous innovation centres and the knowledge and competencies of universities and research centres.

The policymaker expected the poles to expand the pool of users of innovation services. By contacting firms and mapping their needs, the poles would help them to find the most appropriate knowledge-intensive services. In so doing, SMEs would improve their innovation capabilities, which would generate positive spillovers in the regional innovation system. For the first three years, the poles were experimental in character. Afterwards, having evaluated their performance, the policymaker would decide how to structure subsequent interventions. The policymaker's idea was that during the first three years, the poles should have structured their activities. Subsequently, public funding would decline until it disappeared, and the poles would have to cover their activities with market revenues.

In parallel with the funding of the innovation poles, the regional government also provided innovation vouchers to regional SMEs which intended to purchase various types of knowledge-intensive services. These innovation vouchers had been launched in 2008 and, when granted,[1] covered 20–60 per cent on the cost of the service. If the service was purchased from one of the innovation poles, the voucher covered 80 per cent of the cost of the service. Firms that intended to use an innovation pole's services would have to gain membership of that pole. For each pole that was selected for funding, Table 1 lists its key technologies/applications, the number of organisations in the consortium, and the number of member firms at the start (30 June 2011) and end (30 June 2014) of the three-year period.

3.2 Funding and performance evaluation process

Public funding was allocated to innovation poles in two instalments: up to 70 per cent over the course of the three years and the rest at the end. The funding was conditional upon the attainment of a set of minimum performance targets, which had to be achieved by the end of the three-year period. The performance targets had been set at the start of the policy programme, and the poles were aware of these targets from the start. The tender stated that innovation poles would be assigned to one of three possible 'bands', depending on how many members they had at the time of their launch. Different performance targets were set for the different bands. For each innovation pole, targets were defined as minimum thresholds with respect to several indicators (see also Table 2):

i. percentage increase in the number of member firms;
ii. number of member firms that received knowledge and technology mapping services; and
iii. number of services provided to firms and revenue from the sale of services.

To comply with the first indicator, the poles had defined more or less structured procedures for searching and screening local firms. In most cases, such procedures were defined and implemented by the poles' managing organisations and, in particular, by the personnel of the innovation centres, who had previous knowledge of the regional firms. However, as the policymaker wanted the poles to expand the users of innovation services, the innovation centres (technology transfer services and the like) were pushed to look outside of their own circles of contacts.

The knowledge and technology mapping service targeted by the second indicator referred to the analysis of the knowledge, skills, and technologies that firms used to produce their goods and services, and it was performed with the aim to identify possible problems and solutions. Check-ups were done at the member firms by personnel recruited by the poles specifically for performing this service. The poles had on average five people dedicated to this service. In most cases, these individuals combined theoretical knowledge of a technological type (e.g. a degree in engineering) with applied knowledge related to a specific sector. Some had a consultancy agreement with the pole's managing organisation, whereas others were full-time employees of the pole's managing organisation.

Finally, in order to offer the knowledge-intensive services to which the third indicator refers, the poles relied on the skills, knowledge, and material infrastructure of their consortium members.

The information presented above and the analysis that will be developed in the following sections build upon several data sources, listed in Table A.1 in Appendix, which the authors assembled as

Table 2. Performance targets and maximum funding that could be claimed by innovation poles in each of the three bands.

	Criterion for allocation into bands: Number of member firms (at launch)	Performance targets to be achieved within three years (minimum thresholds)				Maximum funding that could be claimed from the regional government (€)
		Percentage increase in the number of member firms	Number of firms to be offered knowledge and technology mapping services	Number of knowledge-intensive services to be offered	Revenue from the sale of services (€)	
Band 1	>160	50	160	40	500,000	800,000
Band 2	>80	50	80	20	300,000	600,000
Band 3	>40	50	40	10	150,000	400,000

Table 3. Policy objectives, performance indicators, and misaligned behavioural incentives.

Policy objective	Performance indicators	Indicator-induced behavioural incentives that are misaligned with policy objectives
To promote and meet the demand for innovation, particularly from SMEs and weaker firms, which are unable to express such demand	Minimum percentage increase in number of member firms Minimum number of new member firms to be offered knowledge and technology mapping services	Choosing firms that are easy to reach (e.g. firms that are known to them beforehand) rather than the weakest firms
To expand the number of firms accessing high value-added knowledge-intensive services	Minimum number of knowledge-intensive services to be offered Minimum revenue from the sale of services	Providing services to firms that are already accustomed to buying knowledge-intensive services rather than expanding the pool of service users
To help firms gain access to scientific and technological knowledge and to networks and resources at national and international levels To support the sharing of equipment and certification labs	–	Avoiding these activities (or investing very little effort in performing them) because they are not relevant to performance assessment

part of a research team engaged in the analysis of the policy programme.

4. Misalignment between performance indicators and policy objectives

4.1 Behavioural incentives created by performance indicators

In order to identify any misalignment between the ultimate aims of the policy and the performance indicators that were set by the regional policymaker, we review the indicators in light of the objectives stated in the policy documents (Table 3). By establishing a logical link between the policy's objectives, on the one hand, and the performance indicators designed by the regional policymaker, on the other, we can identify whether these indicators might have created behavioural incentives that were misaligned with the policy objectives (Table 3, third column).

The first policy objective—to promote a 'demand for innovation'—was addressed by two indicators (minimum percentage increase in number of member firms and minimum number of new member firms to be offered knowledge and technology mapping services) that measured the poles' engagement in recruiting members and marketing services to them. These indicators focused on the direct outputs of the poles' activities (they measured how many firms were approached) rather than on the outcomes achieved by the targeted SMEs in terms of improved awareness of available technologies and opportunities that could help them to innovate and increase their competitiveness. The indicators were, therefore, not completely aligned with the policy objective to solve the lack of information and awareness that affected local firms, and they may even have created behavioural incentives that undermined the attainment of this objective. In fact, in order to easily meet the performance target, the innovation poles could have chosen to approach firms that were easier to reach (e.g. firms that were already known to the poles' consortium members before the start of the poles' activities), rather than the weakest firms—that is, firms that lacked not only specific knowledge, competencies, and technologies but also the awareness of what knowledge, competencies, and technologies they would need in order to retain or improve their competitiveness.

The second policy objective was to boost SMEs' innovation capabilities by expanding the pool of firms accessing high value-added knowledge-intensive services. The guidelines provided by the regional policymaker stated that poles should have offered knowledge-intensive services to regional firms, particularly targeting firms that had not demanded services previously. The remaining two indicators (minimum number of knowledge-intensive services to be offered and minimum revenue from the sale of services) were linked to this objective, although, in this case as well, the link was very loose. These indicators focused on the direct outputs of the poles' activities (they counted how many services were sold and their value) rather than on the outcomes achieved by the targeted SMEs in terms of the enlargement of the pool of users of knowledge-intensive services

Table 4. Performance targets and their achievement.

Innovation pole	Percentage increase in the number of member firms (above the minimum initial threshold for each band)	Firms with knowledge and technology mapping (*n*)	Services provided (*n*)	Revenue (€)
Minimum target for Band 1	**50**	**160**	**40**	**500,000**
Poles' final performance				
OTIR 2020	213[a]	278[a]	93	1,592,970[a]
PENTA	120[a]	236[a]	100	911,084[a]
POLIS	303[a]	274[a]	88	1,022,348[a]
CENTO	101[a]	190	115[a]	1,739,283[a]
POLO12	146[a]	249[a]	267[a]	1,924,012[a]
POLITER	338[a]	286[a]	191[a]	2,259,204[a]
Minimum target for Band 2	**50**	**80**	**20**	**300,000**
Poles' final performance				
INNOPAPER	73[a]	94	455[a]	711,608[a]
PIERRE	363[a]	120	64[a]	1,082,638[a]
Minimum target for Band 3	**50**	**40**	**10**	**150,000**
Poles' final performance				
OPTOSCANA	130[a]	56	42[a]	312,210[a]
VITA	295[a]	73[a]	31	249,893[a]
PIETRE	205[a]	81	18	1,799,400[a]
NANOXM	222[a]	44[a]	25	880,223[a]

[a]Poles that achieved the target within the first three semesters of activity. Reference period: 1 July 2011–30 June 2014.

(poles offering services to SMEs that had not demanded them previously) and of the increase in the innovation capabilities of those that were already using those services (poles offering more advanced services to those firms that were already demanding services). The indicators were misaligned with the objective to expand the pool of firms accessing high value-added knowledge-intensive services and may even have created behavioural incentives that undermined this policy objective. In order to easily achieve the targets, the poles could have provided services to firms that were already accustomed to buying knowledge-intensive services, rather than expanding the pool of users by offering services to firms that had not demanded them previously.

The policymaker also intended to stimulate productive interactions in the innovation system by supporting firms' access to scientific and technological knowledge and to networks and resources at both national and international levels and by supporting the sharing of equipment and certification labs. The poles should have supported these objectives by helping their members to participate in regional, national, and European R&D projects; by organising knowledge transfer programmes, workshops, and seminars to facilitate knowledge sharing and networking among members; and by managing their open-access infrastructure, such as the research laboratories present in the region. Instead, no performance indicators were set that could be linked to these objectives. As a consequence, the innovation poles might have decided not to perform these activities, or to invest very little effort in performing them, because they were not relevant to the evaluation of their performance.

4.2 The behaviour of innovation poles in relation to their performance targets

Table 4 summarises the results achieved by each innovation pole in the period 2011–14, ordered by band, and indicates (marked with superscript 'a') those cases in which the targets had been achieved in less than 18 months (i.e. less than half of the duration of the programme). All poles had achieved all of their performance targets within two years. This might suggest either that the targets were probably too modest or that the intermediaries strategically implemented actions aimed at achieving the targets rapidly. Obviously, this is not a problem *per se*. In our case, the problem is that the target that the poles were trying to rapidly achieve was misaligned with respect to the ultimate policy goal.

Because the performance targets had been set at the start of the programme, and the performance of all twelve poles was measured by means of the same set of indicators, it is not possible to investigate whether the poles' behaviour, given these targets, was different from the way in which they would have behaved in the absence of these targets, or the behaviour they would have had if different targets and indicators had been used to measure their attainment. The lack of a control group that was not subjected to the same targets prevents us from analysing the direct effects of the targets on the poles' behaviour. Instead, we analyse whether the poles adopted the three types of misaligned behaviours shown in Table 3 and to what extent these behaviours were more prevalent in the period before the target had been attained than in the period following its achievement. To analyse whether the poles recruited members among firms that were easy to reach, we consider the share of member firms that had participated together with one or more of the poles' consortium members in previous regional policy interventions and, thus, were already known to the poles' consortium before the start of the policy, over the total number of member firms.

We found that, on average, 7.2 per cent of member firms had already cooperated with the poles' consortium members in previous funded projects. This percentage rises for some poles that were very active in previous policies, such as Optoscana, Otir 2020, or Innopaper. During their three years of activity, the poles' consortia continued to attract firms that had been their partners in previous policies, but at a decreasing rate from 10.8 per cent in the first

Table 5. Share of member firms that had participated in previous regional policy interventions together with one or more of the poles' consortium members.

Pole	In total (%)	Share of firms		
		Before achieving the target (%)	After achieving the target (%)	Difference before/after achieving the target
OPTOSCANA	21.1	33.3	0.0	+
INNOPAPER	9.2	7.4	0.0	+
OTIR 2020	9.8	16.4	3.4	+
VITA	7.7	14.5	3.4	+
PIETRE	8.5	–	3.7	n.a.
PENTA	2.1	0.9	0.8	+
POLIS	5.5	9.9	2.0	+
NANOXM	13.3	12.3	1.1	+
CENTO	3.4	2.6	0.4	+
PIERRE	8.0	–	4.6	n.a.
POLO12	5.1	5.3	1.3	+
POLITER	8.4	0.0	3.1	–
Average	7.2	10.3	2.0	

Note: Reference period: 01 July 2011–30 June 2014. n.a., not available.

semester of activity to 2.6 per cent in the last semester. Table 5 shows the average shares of member firms that had interacted with the poles' consortia in previous regional policy interventions, also distinguishing between the periods before and after the target had been reached. Two poles (Pietre and Pierre) achieved their membership targets at the start of the programme, so the comparison could not be performed. Of the remaining ten poles, nine had recruited a greater share of members that were already known to the consortium before achieving the target, whereas this share dropped once the target had been achieved. This suggests that most poles strategically recruited members among their existing networks in order to more rapidly reach their targets. Across all the poles, the average share of firms that had participated together with one or more of the poles' consortium members in previous regional policy interventions was 10.3 per cent before the targets' achievement and 2 per cent after the targets' achievement, and this difference was significant at 5 per cent (P-value 0.023).

To analyse whether the poles provided services to firms that were already accustomed to demanding them, we considered the share of services provided to firms that had already received a voucher to buy knowledge-intensive services before demanding a service from the poles, on the total number of services provided by the latter.

On average, over one-third (35.2 per cent or 206 firms) of the 586 member firms that bought services from the poles had already requested services from the previous policy programme. As shown in Table 6, 27.2 per cent of the number of services provided by the poles was bought by these firms. Moreover, 41.5 per cent of the value of these services was generated by these deals. Therefore, these firms demanded more expensive (which generally meant more complex and more knowledge-intensive) services than the other member firms. It is also interesting to observe that half of the firms that had already requested services from the previous policy programmes went on to demand the same type of services from the poles. For these firms, the poles appear to have simply crowded out other service providers.

Table 6. Services provided to firms that were already accustomed to demand knowledge-intensive services.

Pole	On total number of services (%)	On total value of services (%)
OPTOSCANA	15.4	0.7
INNOPAPER	8.0	28.3
OTIR 2020	47.2	79.7
VITA	8.8	17.9
PIETRE	–	–
PENTA	34.3	48.5
POLIS	49.5	57.1
NANOXM	37.2	29.9
CENTO	46.7	58.5
PIERRE	25.0	25.4
POLO12	24.4	42.4
POLITER	45.3	55.0
Average	27.2	41.5

Note: Reference period: 01 July 2011–30 June 2014. Data for PIETRE are missing.

Table 7 compares the share of services that were provided to firms that had already requested services from the previous policy programme, in the two periods before and after the targets on the number and value of services were achieved. Columns 1 and 2 report the share of knowledge-intensive services provided to firms that were already accustomed to demanding knowledge-intensive services, before and after the target on the number of services was achieved. All poles for which data are available provided a higher share of services to firms that were already accustomed to demanding them before the achievement of the numbers target than afterwards.[2] Across all poles for which data are available, the mean share of services provided to these firms is 42.1 per cent before the achievement of the numbers target and 12.4 per cent afterwards, and this difference is only marginally not significant (P-value 0.14). Columns 4 and 5 of Table 7 also show that the shares of knowledge-intensive services provided to firms that were already accustomed to demanding them were higher before the achievement of the value target than afterwards. Across all poles for which data are available, the mean share of the value of services provided to these firms was 28.5 per cent before the achievement of the value target and 8 per cent afterwards, and this difference is significant at 10 per cent (P-value 0.055).[3] The evidence suggests that this behaviour could have been adopted instrumentally in order to achieve the value and numbers targets.

To analyse whether the poles avoided activities whose performance was not measured by indicators, we consider the supply of services related to national and international networking and to the sharing of equipment and certification labs. Our interviews with the poles managing organisations suggest that eleven poles out of twelve carried out activities in order to support member firms' access to scientific and technological knowledge and to networks and resources at the national and international levels. This would suggest that, despite the absence of specific performance indicators, the poles did perform these activities. However, our interviews also highlighted that the innovation poles did not systematically collect information about these activities. Moreover, about 40 per cent of the member firms that we interviewed claimed to have been contacted by the poles only once, with the objective to recruit them as members. Therefore, the poles seem to have put limited effort into performing

Table 7. Share of services provided to firms that were already accustomed to demand knowledge-intensive services.

Pole	Before achieving the targeted number of services (%)	After achieving the targeted number of services (%)	Difference	Before achieving the targeted value of services (%)	After achieving the targeted value of services (%)	Difference
	(1)	(2)	(3)	(4)	(5)	(6)
OPTOSCANA	–	4.9	n.a.	-	4.9	n.a.
INNOPAPER	–	3.7	n.a.	5.9	1.4	+
OTIR 2020	80.0	11.3	+	80.0	11.3	+
VITA	–	37.8	n.a.	5.1	1.2	+
PIETRE	–	–	n.a.	–	–	n.a.
PENTA	14.3	12.5	+	41.5	5.9	+
POLIS	–	14.6	n.a.	14.5	–	n.a.
NANOXM	44.4	17.8	+	–	17.8	n.a.
CENTO	–	7.1	n.a.	–	13.4	n.a.
PIERRE	–	6.9	n.a.	–	6.9	n.a.
POLO12	–	7.8	n.a.	23.1	4.6	+
POLITER	29.6	12.4	+	29.6	12.3	+
Average	42.1	12.4		28.5	8.0	

Note: Reference period: 01 July 2011–30 June 2014. n.a., not available.

outreach activities beyond those that were measured by the performance indicators.

Summarising throughout the empirical analysis, we found some evidence that the performance indicators had only limited effectiveness in inducing the poles to behave in line with the policy's objectives. The poles built their network of members by extensively relying on their network of preexisting connections, rather than looking to support also the many other weakest firms of the region. Many of the services were provided to firms that had already demanded services beforehand, instead of looking to expand the pool of users of these services. We found that 35.2 per cent of the firms that demanded services from the poles would have been able to buy them even without the intermediation of the poles, because they had already bought knowledge-intensive services using a preexisting policy incentive. Moreover, half of these firms bought exactly the same services from the poles that they had bought from other service providers before the poles were introduced. With regard to these firms, the poles simply crowded out other service providers instead of providing different services. Finally, activities for which performance targets had not been set were carried out only to a limited extent. As a note of caution, we must say that while the chosen performance indicators seem to have incentivised the poles to behave in ways that were misaligned with the policy's objectives, this does not mean that the policy as a whole was not impactful. Establishing the extent to which the policy had an additional impact would require an appropriate *ex post* evaluation, possibly including a counterfactual analysis (see, for instance, Bellégo and Dortet-Bernadet 2014).

5. Towards a better approach to evaluating the performance of innovation intermediaries

As discussed in detail in the previous section, the performance indicators used by the regional government had several limitations. First, they were incomplete because they focused on only some of the poles' activities. Secondly, they were not explicitly designed to support the achievement of policy objectives, being focused on some direct and short-term outputs of the poles' activities rather than on longer-term outcomes attained by the SMEs that the intermediaries were supposed to support. Much of the recent debate on the evaluation of intermediaries' performance concerns the need to introduce outcome indicators that capture significant changes in the behaviours of beneficiary firms and significant social and economic effects at various levels of analysis (Knockaert et al. 2014). However, the problem of alignment with policy objectives remains. In order to define effective performance indicators (especially, but not only, when they are used to allocate public funding), policymakers need to ensure not only that indicators focus on outcomes rather than solely on outputs but also that these indicators align closely with the policy's objectives.

To encourage the innovation poles to act in accordance with the policies' objectives outlined by the regional government, the indicators used for performance evaluation should have captured whether (1) poles had increased firms' awareness of available technologies suited to their innovation needs, particularly regarding SMEs and firms that had a lower propensity to innovate; (2) poles had expanded the pool of firms accessing high value-added knowledge-intensive services; and (3) poles had helped firms to access scientific and technological knowledge and networks and resources at the national and international levels, including equipment and certification labs.

These indicators could have measured not only the outputs of the poles' activities, both direct and indirect ones (i.e. follow-up activities that resulted from the former), but it would also have been important to include, if the policy's time scale allowed it, the outcomes achieved by the beneficiary firms thanks to the poles' activities. In fact, the beneficiary firms could have improved their capabilities to engage in innovation (e.g. through better communication and negotiating skills, greater awareness of their own abilities and limitations, greater understanding of the process of collaboration, and greater trust and openness towards external collaborations), thanks to the resources (information, services, and contacts), and learning opportunities provided by the innovation poles. Therefore, outcome indicators could have measured whether, thanks to the poles' activities, the economic actors had changed their behaviours (e.g. in terms of the amount of networking activity, the

Table 8. Policy objectives and proposed indicators.

Policy objectives	Proposed indicators
Poles should promote and meet the demand for innovation, par-ticularly in SMEs and more fragile firms which were unable to express such demand	*Output:* Number of new (not previously known) firms recruited; number and value of follow-up activities carried out with the firms recruited *Output:* Number of new (not previously known) firms mapped; number of new firms that were offered mapping services and that engaged in follow-up activities *Outcome:* Changes in firms' innovation behaviour; changes in the nature and types of investments in innovation; changes in the nature and value of the research project proposals submitted and funded; changes in the firms' innovation strategies
Poles should expand the number of firms accessing high value-added knowledge-intensive services	*Output:* Number and value of services provided or intermediated by the innovation intermediary to firms that had not demanded this kind of service before or that had never demanded services; number and value of subsequent services provided to these firms *Output:* Number and share of firms receiving services directly provided or mediated by the innovation intermediary that had not demanded this kind of service before or that had never demanded services; number of firms receiving services that requested further services *Outcome:* Changes in firms' demand for knowledge-intensive services; changes in the number of firms demanding services; changes in the number and value of services demanded
Poles should help firms gain access to scientific and technological knowledge and to networks and resources at national and international levels Poles should support the sharing of equipment and certification labs	*Output:* Number of events held (by type of event) and number of laboratories accessed through the poles' intermediation; number and value of follow-up activities carried out with these firms (e.g. applications to call and support for start-up creation) *Output:* Number of firms participating in events; number of new firms that accessed laboratories; number of firms involved in events/labs activities and that engaged in follow-up activities *Outcome:* Changes in firms' networking behaviour: changes in the size and composition of networks of relationships; changes in the number and types of collaborative projects

types of partners they interacted with, and the type of innovation processes they performed) and possibly their performance (more innovation, greater profitability, and so on).

In order to capture the actual contribution of the innovation poles to the changes in the behaviours of the beneficiary firms, outcomes can be evaluated not only descriptively but also causally through the counterfactual tools of the so-called econometrics of programme evaluation (Imbens and Rubin 2015). While the application of these tools to the field of the evaluation of intermediaries' performance is still in its infancy, they are gaining ground as a tool for the evaluation of innovation policy (see, for instance, Bellégo and Dortet-Bernadet 2014; Innovate UK 2017).

Table 8 summarises possible measures for the evaluation of the poles' performance. The proposed measures are classified according to their policy objective and their type (direct and indirect output or outcome indicators). Compared with the indicators that were actually used in the policy programme under analysis, these indicators include a mix of output and outcome, short- and longer-term indicators, which are purposefully aligned with the policy's objectives.

6. Conclusions

In recent years, policymakers have relied on intermediaries to stimulate firms' innovation capabilities by helping them to acquire new knowledge, competencies, and technologies. In addition, such intermediaries can play an important role in stimulating virtuous interactions between actors within an innovation system, and they can strengthen the innovation system as a whole. However, if the intermediaries' incentives are not aligned with the pursuit of these objectives, there are few reasons to believe that these objectives will be achieved.

Our analysis shows that the indicators (and related performance targets) used in the policy under study suffered from several common shortcomings that were already identified by the public policy literature and were not fully in line with the policy's objectives. The intermediaries' behaviour was, at least in part, affected by the attempt to achieve the performance targets on which funding was conditioned, which led to a misalignment with the policy objectives. First, the indicators measured only some of the poles' activities and not others, possibly due to the greater difficulty in setting indicators for less well-defined activities, such as networking and project development. This incentivised the poles to focus more on those activities that were measured, further confirming that 'only what gets measured gets done' (Davies 1999). Secondly, the indicators focused on short-term outputs that were considered desirable in themselves (Langford et al. 2006; Comacchio and Bonesso 2012), such as recruiting a minimum number of members and providing a minimum number of services, rather than on more complex, less quantifiable *outcomes* aligned with policy objectives. This led poles to recruit members that were easier to reach, rather than focusing on the weakest firms, and to offer knowledge-intensive services to firms that did not necessarily need the intermediation of the poles, rather than spreading these services to new users.

This analysis allows us to draw some more general implications for the design of performance indicators that would encourage intermediaries to address the policy's objectives most appropriately.

First, policymakers should identify the full range of intermediaries' activities and pay particular attention to those that are instrumental in addressing the key objectives, thereby avoiding the risk of omitting important activities from the evaluation just because they are less visible or less easy to measure.

Secondly, to be fully aligned with policy objectives, performance indicators should ultimately measure whether the beneficiary firms have achieved relevant policy outcomes thanks to the resources (information, services, and contacts) and learning opportunities provided by the intermediaries. Policy outcomes typically involve improvements in the beneficiary firms' capabilities to engage in innovation (e.g. through better communication and negotiation skills, greater awareness of their own abilities and of their limitations, greater understanding of the process of collaboration, and greater trust and openness towards external collaborations), which, in turn, would lead to changes in their behaviours (e.g. greater networking activity, changes in the types of partners they interact with, and changes in the type of innovation processes they perform) and possibly in performance (more innovation, greater profitability, and so on).

The design of performance indicators is constrained by the presence of several trade-offs, which do not always allow such a broad-ranging approach to performance evaluation. First, accurate indicators often mandate the collection of a large amount of information, which requires intermediaries to invest a substantial proportion of their resources in the evaluation process; intermediaries often consider this data collection activity a burden which limits their ability to engage in more productive activities. The provision of appropriate digital information collection systems as part of the policy evaluation toolkit would help intermediaries to collect the data needed for performance evaluation without the need to invest their own resources in expensive data collection processes. A well-designed performance-based funding system would simultaneously provide intermediaries not only with appropriately designed indicators, which avoid the creation of misaligned behavioural incentives, but also with accurate systems to support their strategic management, which would allow them to easily collect the data needed to build these indicators.

Secondly, in order to fully capture policy outcomes, indicators may also require that measurement occurs a long time after the policy intervention has been completed, but this long timescale may not be feasible when the evaluation is supporting the allocation of public funding and, therefore, needs to be finalised in a relatively short period. In these cases, to avoid excessive complexity, the policymaker could focus on output indicators that are strongly aligned with the desired outcomes of the policy (while not capturing these policy outcomes fully).

Despite the growing number of policies funding innovation intermediaries, limited evidence exists regarding how these issues have been addressed in practice. Further research should explore a greater range of practices adopted in the areas of indicator design and information collection systems supporting the activities and evaluation of innovation intermediaries and the extent to which these practices are linked to better performance of intermediaries and greater achievement of policy objectives.

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Notes

1. Admission to the incentive was semi-automatic. It was based on compliance with a set of formal criteria, including company size.
2. The comparison is possible for four poles only; this is because seven poles achieved the target immediately (during the first semester), and for another one, data were missing.
3. In the case of the target on the number of services, the comparison is possible for six poles only; this is because four poles achieved the target immediately (during the first semester), one did not achieve the target, and for another one, data were missing.

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Appendix

Table A.1. Data sources.

Type of data	Source
Data on poles' structure and activities	• Administrative data provided by Tuscany's regional government (poles' six-month activity reports and other administrative data) • Poles' websites (collected during September–January 2015) • Twenty-seven semi-structured interviews with staff from the organisations managing the innovation poles, some member firms and local business associations (carried out between March and May 2014)
Data on member firms	• Administrative data provided by Tuscany's regional government (data on the policy providing grants to buy knowledge-intensive services) • Interviews to poles' member firms, carried out between September and November 2015
Data on regional administration	• Administrative data provided by Tuscany's regional government (funding schemes for poles and member firms) • Four interviews with policymakers (carried out between March and May 2014)
Data on 2000–6 innovation policies	• Previous research projects of the authors