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## **Designing performance-based incentives for innovation intermediaries: evidence from regional innovation poles**

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### **Abstract**

Innovation intermediaries can play an important role in policies aimed at promoting innovation within local, regional and national innovation systems. However, the intermediaries' behaviour is strongly affected by the incentives that the policy creates, for example through the definition of performance indicators for the allocation of public funding. Drawing on the analysis of a policy programme in an Italian region, the paper highlights the distortive effects of such performance indicators, which induce behaviours that are not aligned with the policy's objectives. Using a system failure approach to the analysis of the objectives of publicly-funded innovation intermediaries, we argue that performance indicators should be clearly aligned with the policy objectives to remedy particular system failures, and we put forward a set of indicators that can be used for the

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**Keywords:** innovation policy; regional policy; innovation intermediaries; innovation poles; performance-based funding; evaluation; technology transfer

## **1. Introduction**

Intermediary organisations that support firm-level and collaborative innovation, often called 'innovation intermediaries', have gained increasing prominence in knowledge-intensive economies (Howells, 2006; Lazaric et al., 2008). They provide a range of knowledge-intensive services that include, among others, knowledge and technology mapping, research and development (R&D) partnership formation, technical assistance in R&D projects, dissemination and commercialisation of results, and technology transfer (Lee et al., 2010; Wagner et al., 2014).

Since innovation intermediaries can facilitate knowledge exchange among organisations with different languages, cultures, decision-making horizons, systems of incentives and objectives (Howells, 2006; Russo and Rossi, 2009;

Caloffi et al., 2015), they can play an important role in policies aimed at promoting innovation within local, regional and national innovation systems (see e.g. Kauffeld-Monz and Fritsch, 2013). In recent years numerous policy interventions have funded organisations performing at least some innovation intermediary functions, particularly at regional level. Examples are the Regional Competitiveness Poles in France, the Collective Research Centres in Belgium, the Strategic Centres for Science, Technology and Innovation in Finland, and the Innovation Poles in Italy (Martin et al., 2012; Uotila et al., 2012; Knockaert et al., 2014; Fiordelmondo et al., 2014).

In this context, appropriate instruments to evaluate the performance of publicly-funded innovation intermediaries are increasingly required. A debate has emerged on the key performance dimensions of innovation intermediaries' activities, with a view to support programme evaluation processes (Klerk and Leeuwis, 2009; Dalziel, 2010; Dalziel and Parjanen, 2010).

However, not much discussion has yet taken place around the implications of using ongoing performance evaluation as a basis for the allocation of public funding to intermediaries. Mechanisms to link public funding to performance are usually developed heuristically, often based on past experience, rather than on solid theoretical underpinnings (Sizer, 1979; Jesson and Mayston, 1990; Molas-Gallart and Davies, 2006). It has been shown that such heuristic approaches can result in the development of partial performance 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). This is problematic not only because it distorts the evaluation of performance, but also because indicators often provide an implicit incentive system that alters the behaviour of the assessed units (Langford et al., 2006; Rafols et al., 2012; Texteira and Koryakina, 2013), possibly in ways that do not contribute to the achievement of the overall policy objectives.

This study intends to shed light on the relationship between performance-based funding and policy objectives. Building on a review of the literature on innovation intermediaries and their functions within innovation systems, we suggest that policy interventions supporting innovation intermediaries usually have the implicit or explicit objective to solve systems failures (Klein Woolthuis et al., 2005) and that performance indicators should incentivize intermediaries to

address these failures so as to support the achievement of policy objectives.

However, we argue that the indicators used in practice may promote behaviours that are not aligned with such objectives. Relying on a case study of publicly-funded innovation intermediaries in the Italian region of Tuscany in 2011-2014, we analyse the behavioural incentives introduced by the indicators used to allocate public funding and, based on a systems failure framework, we attempt to identify a set of improved performance measures for the evaluation of these intermediaries.

The paper is organized as follows. Section 2 provides a brief overview of the functions of publicly-funded innovation intermediaries within innovation systems, highlighting their role in addressing system failures, and proposes a conceptual framework that links the intermediaries' performance to the objective to remedy innovation system failures. Section 3 introduces our case study of twelve publicly-funded innovation intermediaries, called 'innovation poles', and describes our methodology. In Section 4, we illustrate how innovation poles responded to the incentives created by the performance indicators used to allocate funding, and the extent to which their behaviours were consistent with the policymakers' objectives. Section 5 presents a preliminary and tentative analysis of the potential distortive effects of the performance-based indicators defined by the policymaker. Drawing on this analysis, the following section 6 discusses how performance indicators could be improved in this setting. Section 7 presents some conclusions and implications for policy.

## **2. The objectives of policies funding innovation intermediaries: a systems failure view**

The concept of innovation intermediary is used in the innovation literature, particularly in the systems of innovation perspective, to broadly identify a varied set of organisations that differ in nature (e.g. knowledge-intensive business services, technopoles, technology transfer agencies, science parks) and status (public, private, or mixed), whose activities support innovation processes involving other organisations (Bessant and Rush, 1995; Lynn et al., 1996; Hargadon and Sutton, 1997; Den Hertog, 2000). In one of the earliest attempts to systematize the academic literature on innovation intermediaries, Howells (2006, p. 720) proposed a functional definition of innovation intermediary as “[a]n

organisation or body that acts [as] an agent or broker in any aspect of the innovation process between two or more parties”. Subsequent literature has broadened the focus, suggesting that innovation intermediaries can also perform traditional, non-third-party activities that should be regarded as either sources of innovation or carriers of innovation. Dalziel (2010, p. 1) proposed a comprehensive definition of innovation intermediaries as “organisations or groups within organisations that work to enable innovation, either directly by enabling the innovativeness of one or more firms, or indirectly by enhancing the innovative capacity of regions, nations, or sectors”. Their functions include the provision of information and advice, transaction brokering, mediation, facilitation of promotion and influence, community and consensus building, training, capacity building, demonstration and problem-solving (Super-Sme Consortium, 2006; Howard Partners, 2007; Dalziel, 2010; Agogué et al., 2013).

Since, in most cases, intermediaries are defined by their functions rather than by their characteristics (Caloffi et al., 2015), analyses of intermediaries include a variety of organisations, mainly from the private sector (Smits and Kuhlmann, 2004) such as innovation consultants (Klerkx and Leeuwis 2009), knowledge intensive business service providers (Howells 2006) and innovation brokers (Batterink et al., 2010; Klerkx, Hall and Leeuwis, 2009), but also, increasingly, publicly or public-privately funded organisations such as research-industry liaison offices, science parks (Hansson et al., 2005), chambers of commerce and associations (Super-Sme Consortium, 2006).

In recent years, innovation intermediaries have been targeted by policies supporting innovation and technology transfer. Such policies, which usually refer, more or less explicitly, to an innovation system perspective (Freeman, 1987; Lundvall, 1992; Nelson, 1993; Edquist and Johnson, 1997), aim at addressing system failures in order to strengthen the performance and relationships of the system’s actors. In their pioneering work, Klein Woolthuis et al. (2005) identified four main broad types of system failures that policy can address. Infrastructural failures refer to the lack of physical and communication infrastructures, as well as to the lack of a science-technology infrastructure in the system (see also Malerba, 2009). Capabilities failures can occur when firms lack the competences, capacity or resources to learn and innovate. One such failure occurs when existing core capabilities generate ‘competence traps’ which lead actors to focus on what they

know how to do well, disregarding more productive and innovative alternatives (Malerba, 2009). Interaction failures relate to the lack of productive interactions between actors in the system. Institutional failures relate to the lack of formal (e.g., technical standards, labour laws, IPR) or informal institutions (e.g., social norms and values) supporting innovation.

Intermediaries may act in all four areas. First, intermediaries can remedy a failure in the information infrastructure of the innovation system. They can diffuse information on opportunities for collaborations with other actors (Bougrain and Haudeville, 2002), as well as on useful and applicable techniques or technologies for product and service development (Howard Partners, 2007; Rosenkopf and Nerkar, 2001).

Second, intermediaries can play a role in helping firms, particularly small and medium-sized enterprises (SMEs), to boost their innovation capabilities by directly providing training or support services, or by intermediating the provision of services that are able to solve the actors' managerial failures, which are a form of capabilities failures (Bessant and Rush, 2005). These failures occur when firms, even if they know of the existence of useful knowledge or technologies, are unsure as how to go about acquiring them, or how to usefully implement them into product and services. Moreover, through activities such as knowledge and technology mapping, innovation intermediaries can help actors gain awareness of the competences and knowledge they are lacking, in order to find the right way to obtain them. Indeed, actors may not just lack certain knowledge or competences but may be unaware of what they are lacking (Brusco, 1992; Kaufmann and Todtling, 2002), which is a form of 'awareness failure'.

Fourth, intermediaries can create connections between people in different organisations, through networking activities such as targeted introductions and meetings, general networking, and provision of appropriate interaction spaces where actors can meet freely (Etzkowitz and Leydesdorff, 1998; Acworth, 2008; Kodama, 2008; Rossi et al. 2009). This can be particularly helpful for newly created firms and SMEs, which are usually less open than other organisations to external collaborations (Rothwell and Dogdson, 1991). Intermediaries can support interactions also because they are (supposed to be) able to bridge different knowledge and competencies. One of their main capabilities is precisely that to solve cognitive failures, which occur when actors from different institutional

backgrounds are too cognitively distant to adequately learn together (Nooteboom, 2000), or have different norms, values and incentive systems that hinder effective communication (Klerkx and Leuwis, 2009).

Finally, intermediaries can perform a number of activities that allow them to address the lack of formal or informal institutions supporting innovation. In particular, they can provide information, advice or other services related to formal institutions to firms (for example, consultancy for the acquisition of a patent). Furthermore, they can facilitate the emergence of social norms that are the basis of a good innovative performance, as when their support to collaborations promotes mutual trust.

The activities of publicly-funded innovation intermediaries ultimately aim to remedy the sources of system failures by providing the economic actors that operate in the system with resources (information, connections, external services) and by involving them in learning processes aimed at improving their capabilities (improvement in technical, organisational, managerial competences, communication abilities, interaction abilities). These resources and capabilities, in turn, should allow actors to change their innovation behaviours as well as improve their innovation performance. Table 1 summarizes the key system failures that publicly-funded innovation intermediaries can address, and the activities through which they may do so, with the ultimate objective to strengthen their innovation system.



**Table 1. Key functions and related activities of publicly-funded innovation intermediaries**

<b>General system failures categories</b>	<b>Specific system failures that can be addressed by intermediaries</b>	<b>Sources of system failure</b>	<b>Examples of innovation intermediaries' activities that can help solve system failures</b>
<b>Infrastructure failures</b>	Information failures	Economic actors lack information about sources of external knowledge and opportunities	Diffusion of information about existing opportunities
<b>Capabilities failures</b>	Managerial failures	Economic actors are unable to exploit knowledge and opportunities due to lack of adequate competences and skills	Direct provision of knowledge-intensive services Intermediation in the provision of knowledge-intensive services Training and education activities
<b>Interaction failures</b>	Awareness failures	Economic actors lack awareness of their own needs for information, knowledge, competences	Knowledge and technology mapping
	Networking failures Cognitive failures	Economic actors lack connections between them, due to weak or strong network failure Economic actors are unable to interact due to cognitive distance	Targeted introductions and meetings General networking Provision of interaction spaces Leading collaborative innovation projects Leading communication within interaction spaces Mobilizing resources for collective initiatives
<b>Institutional failures</b>	Formal or informal institutional failures	Economic actors are unwilling to innovate due to the lack of formal or informal institutions	Diffusion of information that can help the diffusion of formal institutions (e.g. on standards or IPRs) Direct provision of services related to formal institutions (e.g., support for applying for a license or a certification) Lobbying activity towards policymakers to stimulate the creation of formal institutions Facilitating the emergence of social norms that promote collaboration

The allocation of public funding to innovation intermediaries is rarely linked to

their ability to deal with system failures, even though the system failure framework provides an implicit or explicit rationale for these policies. While most evaluation exercises involve the use of performance indicators that relate to some of the activities mentioned in Table 1, in order to incentivize the production of specific outputs that are considered desirable, little attention is paid to the behavioural incentives that these performance indicators create, in order to ensure that the behaviours that they incentivize are aligned with the policy objective to remedy particular system failures.

It is well known that the choice of performance indicators on the part of policymakers can influence the beneficiaries' behaviour. As aptly pointed out by Fitz-Gibbon (1990, p. 2) "for every performance indicator questions must be asked about the implicit messages, and the behavioural implications. In other words, knowing that certain indicators are being collected and monitored, what implications do people draw? How will they respond to the situation?". The choice of a narrow set of output indicators that are relatively easy to measure may induce intermediaries to aim for good performance scores in these indicators, disregarding other potentially important objectives, the attainment of some of which may not be easily measurable. Or, relatedly, intermediaries may be tempted to engage in activities that produce immediate outputs and neglect activities that would yield results only over a longer time horizon than that considered by evaluators. Gulbrandsen and Rasmussen (2012) showed how, in the case of the Forny technology transfer programme in Norway, the indicators used to determine the annual bonus payments for technology transfer offices had to be changed several times, since the latter would alter their strategies in line with the incentives provided by the indicators, sometimes with adverse consequences. In particular, using the number of spinoff companies as an indicator of performance led them to launch too many firms too early.

Therefore, efforts should be made to identify performance measures that incentivize intermediaries to put in place the most appropriate activities to address relevant system failures, and to carry them out to an appropriate extent. Evaluating the performance of innovation intermediaries in light of their objectives to address system failures has two main advantages. First, it encourages the analyst to identify the full range of intermediaries' activities and to pay particular attention to those which are instrumental in addressing the key failures,

this way avoiding the risk of omitting important activities from the evaluation just because they are less visible or less easy to measure. Second, this approach suggests that policymakers should devise performance measures with the aim not only to ensure that the intermediaries produce specific outputs but also to encourage them to achieve outcomes linked to remedying the main sources of system failures: improving the resources (information, networks) and capabilities (competences, skills) of the economic actors in the system, thus leading them to changes in their behaviours and performance.

### **3. The regional innovation poles**

We rely on a case study to illustrate the limitations and implications of the current ways to evaluate the performance of innovation intermediaries, and to showcase an improved approach to performance evaluation, which builds upon the conceptual framework presented. The case study concerns a policy intervention implemented by the Italian region of Tuscany in 2011-2014, through which the regional government funded twelve innovation poles, a particular type of innovation intermediary. The key objectives of innovation poles were listed (Regione Toscana, 2010), as follows:

1. To promote and meet the demand for innovation of the firms that are members of the poles, and, more generally, of all the SMEs in the poles' target sectors
2. To help firms access 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 national and international level
4. To support the sharing of equipment and of research, development testing and certification labs.

The policy intervention unfolded in two stages. In the first stage, Tuscany's regional government identified a set of twelve key technologies/applications, and launched a call for tender (in 2010) inviting organisations to submit proposals for the creation of twelve poles for a three-year period (2011-2014).

The twelve proposals selected for funding were each managed by a consortium. Overall, 46 different organisations (including service providers, universities and firms) were involved in the consortia managing the 12 innovation poles. The poles received regional funds to carry out the following activities:

- marketing to recruit new members (firms that intended to use an innovation pole’s services would have to gain membership of that pole), including mapping activities to encourage firms to demand knowledge-intensive services and to invest in innovation;
- direct provision of knowledge-intensive services;
- participation in regional, national and European R&D projects; organisation of knowledge transfer programmes, workshops and seminars to facilitate knowledge sharing and networking among members;
- management of open access infrastructures such as research laboratories.

In a second stage, the regional government established favourable conditions for member firms to access a support program: firms were given grants to buy knowledge-intensive services that were either directly provided or intermediated by the poles. Through the scouting of new members and the mapping of their needs, the poles should have helped firms – particularly those less able to perform these activities by themselves – to find the knowledge-intensive services appropriate to their needs. Such services could be bought at a discounted price (a reduction of 80% on the cost of the service) thanks to the public incentive. This incentive existed before the creation of the poles: since 2008, SMEs in the region could apply for public funds for the purchase of various types of knowledge-intensive services. The admission to the incentive was semi-automatic (it was based on compliance with certain formal criteria, including company size) and granted a reduction in the range of 20-60% on the cost of the service.<sup>1</sup>

The policymakers’ expected the poles to expand the pool of potential users of innovation services. In fact, a typical problem of SMEs, besides the fact that they only have relatively few internal resources to invest in innovation-related activities, is that they have little understanding of their needs and are unable to ‘demand’ innovation. Such SMEs, particularly those with more difficulty in formulating their innovative needs, should have been the main target of the poles.

<sup>1</sup> The percentage varied according to the type of service and the type of enterprise.

Table 2 lists, for each innovation pole, its key technology/application, the number of organisations in the managing consortium and the number of members at the start (30.6.2011) and end (30.6.2014) of the three year period.

**Table 2. Key technologies/applications, consortium participants, pole members**

<b>Innovation pole (acronym)</b>	<b>Key technologies/applications</b>	<b>N. of consortium participants</b>	<b>N. members as of 30.06.2011</b>	<b>N. members as of 30.06.2014</b>
OPTOSCANA	Optoelectronics for manufacturing and aerospace	2	67	92
INNOPAPER	Paper	1	89	139
OTIR 2020	Fashion (textiles, apparel, leather, shoes, 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	ICT and robotics	13	195	697

Source: our elaborations using data provided by Tuscany's Regional government

Public funding was allocated to the managing organisations of the innovation poles in two installments: up to 70% (provided that a bank guarantee had been presented) over the course of the period, and the rest at the end of the three years. The funding was conditional upon the achievement of a set of minimum performance targets, which were defined in relation to the whole period. 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. Targets were defined as minimum thresholds with respect to several indicators: i) percentage increase in the number of member companies; ii) number of member firms that

were offered knowledge and technology mapping services; iii) number of services provided to firms, and revenue from the sale of services.<sup>2</sup>

Table 4 shows, for each band, the minimum number of members required at the start of the period, the performance targets to be achieved over the three years, and the maximum funding that poles could claim from the regional government had they reached these targets.

**Table 4. The innovation poles' classification into bands: criteria, performance targets and maximum funding that could be claimed**

	Criterion for allocation into bands: N. member companies (at launch)	Performance targets to be achieved within three years				Maximum funding that could be claimed from the Regional government
		% increase in members	n. firms with knowledge & tech mapping	n. knowledge-intensive services provided	minimum revenue	
<b>Band 1</b>	> 160	50	160	40	500,000 €	800,000 €
<b>Band 2</b>	> 80	50	80	20	300,000 €	600,000 €
<b>Band 3</b>	> 40	50	40	10	150,000 €	400,000 €

Source: our elaborations using data provided by Tuscany's Regional government

In what follows we will discuss these indicators in the light of their capacity to promote the achievement of the policy's objectives, and we will provide some evidence about their potential distortive effects.

Our empirical analysis builds upon several data sources, which the authors assembled as part of a research team engaged in the analysis of the policy programme. They are presented in Table 5.

**Table 5. Data sources**

Type of data	Source
<b>Data on poles' structure and activities</b>	<ul style="list-style-type: none"> <li>– Administrative data provided by Tuscany's regional government (Poles' six-months activity reports and other administrative data)</li> <li>– Poles' websites (collected in September – January 2015)</li> <li>– 27 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),</li> <li>– Online survey of poles' managing organisations about the monitoring and evaluation activities they had to comply with (March-April 2015)<sup>3</sup></li> </ul>

<sup>2</sup> It is worth noting that, in Italy, other regions adopting innovation policies similar to Tuscany used similar sets of indicators to evaluate the performance of innovation intermediaries.

<sup>3</sup> The first email inviting the managing organisations to take part in the survey was sent on March 27<sup>th</sup>, 2015, followed by two recalls sent to non-respondents only. 14 (30%) out of the 46 managing organisation re-

	– Focus group with poles’ managing organisations
<b>Data on member firms</b>	– 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
<b>Data on regional administration</b>	– Administrative data provided by Tuscany’s regional government (funding schemes for poles and member firms) – 4 interviews to policymakers (carried out between March and May 2014),
<b>Data on 2000-2006 innovation policies</b>	– Previous research projects of the authors

#### 4. Limitations and implications of the indicators used by the regional government

##### 4.1. The performance of the poles

For each of the targets listed in Table 4, Table 6 summarizes the result achieved by each innovation pole, ordered by band, while Table 7 specifies the period within which they had been achieved. It is evident that all poles had reached their performance targets within two years. All of them had already reached their membership targets by the time they were formally launched.

**Table 6. Performance targets and their achievement**

<b>Innovation pole</b>	<b>% increase in the number of member firms* (above the minimum initial threshold for each band)</b>	<b>Firms with knowledge and technology mapping</b>	<b>Services provided</b>	<b>Revenue</b>
	%	n.	n.	€
<b>Minimum target for Band 1</b>	<b>50%</b>	<b>160</b>	<b>40</b>	<b>500,000</b>
<i>Poles’ final performance</i>				
OTIR 2020	213%	278	93	1,592,970
PENTA	120%	236	100	911,084
POLIS	303%	274	88	1,022,348
CENTO	101%	190	115	1,739,283
POLO12	146%	249	267	1,924,012
POLITER	338%	286	191	2,259,204
<b>Minimum target</b>	<b>50%</b>	<b>80</b>	<b>20</b>	<b>300,000</b>

sponded to the survey, 12 of these being the consortium leaders for the 12 poles. We focused our analysis on the 12 completed questionnaires received from the 12 consortium leaders

**for Band 2**

*Poles' final*

performance

INNOPAPER	73%	94	455	711,608
PIERRE	363%	120	64	1,082,638

**Minimum target                      50%                      40                      10                      150,000**

**for Band 3**

*Poles' final*

performance

OPTOSCANA	130%	56	42	312,210
VITA	295%	73	31	249,893
PIETRE	205%	81	18	1,799,400
NANOXM	222%	44	25	880,223

Note to table: \* member firms include manufacturing companies, business services and KIBS

Source: our elaborations using data provided by the innovation poles to document their performance,

reference period: 1st July 2011-30th June 2014

**Table 7. Timing of achievement of minimum performance targets (semester of poles' activity – total period is 6 semesters)**

<b>Innovation pole</b>	<b>50% increase in member firms above the minimum to start*</b>	<b>Firms with knowledge &amp; tech mapping (in three years)* n.</b>	<b>Services provided** n.</b>	<b>Revenue** €</b>
<b>Band 1</b>				
OTIR 2020	1st semester	3rd semester	Last semester	2nd semester
PENTA	2nd	3rd	5th	4th
POLIS	1 <sup>st</sup>	3rd	4th	4th
CENTO	3rd	Last semester	3rd	1st
POLO12	1st	3rd	2nd	2nd
POLITER	1st	2nd	3rd	2nd
<b>Band 2</b>				
INNOPAPER	4th	5th	1st	4th
PIERRE	At start	4th	2nd	2nd
<b>Band 3</b>				
OPTOSCANA	At start	4th	2nd	1st
VITA	1st	3rd	4th	4th
PIETRE*	At start	4th	3rd	3rd
NANOXM	At start	2nd	4th	3rd

\* Information provided by the innovation poles

\*\* Our elaborations on data provided by the innovation poles

Even a quick glance at the poles' performance suggests that the targets were probably too low, given that most poles reached them very rapidly. Obviously, the target could have been easy to reach in an absolute sense. Alternatively, innovation poles may have strategically implemented actions aimed at achieving the targets, regardless of whether such actions were appropriate at such an early



stage. To assess whether this might have been the case, we investigate several potential distortive effects of the performance indicators.

#### 4.2. Understanding potential distortive effects of indicators

The following Table 8 systematises our reasoning on the potential distortive effects of the policy by linking it to the reflection on the system failures that the policy aimed to address. In particular, the table shows that the link between the policy objectives that the poles should have achieved with their activity (and the underlying types of system failures that the poles should have addressed), and the indicators used by the regional government to measure such activity, are not straightforward. Some activities are not measured, while others are measured only partially.

Both the presence and the absence of indicators can generate distortive effects, for which we define some empirical measures. In particular, the policy objectives, activities and corresponding performance indicators can be grouped into three main categories.

First, the objective to promote and meet SMEs' demand for innovation intends to address the SMEs' lack of information about technologies and innovation opportunities, and their lack of awareness of their own technological needs. This failure is mainly addressed through scouting of new member firms and knowledge and technology mapping activities. The corresponding indicator identified by the regional government captures the percentage increase of the new members and the number of new firms that are offered knowledge and technology mapping services. However, this indicator can produce some distortive effects. In particular, indicators based on the increase in the number of members may have induced poles to simply recruit members without intending to work closely with them but just to achieve their targets. Moreover, they might have been tempted to contact firms that were easy to reach, for example those they were already working with, rather than focus on bringing new firms into their networks. Similarly, the presence of an indicator based on the number of firms that are offered knowledge and technology mapping services may have induced poles to contact firms that were easy to involve in such activity, for example those they were already working with prior to the start of the innovation poles programme.

Second, the objective to help firms access high value-added knowledge-intensive services (second row in Table 8) is aimed at compensating for SMEs' lack of internal capabilities (managerial failures). The corresponding indicators capture the number of services directly provided, and the corresponding revenue generated from these services. Again, these indicators are partial and can generate undesirable results. As for the limitations, we note that performance indicators referred only to services provided directly by the poles and left out any intermediation activities. This limitation was also highlighted by the poles themselves, in our online survey of the poles' managing organisations, and during the focus group discussion. The potential distortive effects of the indicators refer to the fact that the absence of indicators related to the intermediation activities may have pushed the poles to focus on selling services, rather than operate as facilitators of relationships and learning processes within the region. Moreover, indicators based on the number and values of services provided may have induced poles to provide services to firms that were already used to buy services because they were already receptive to them, rather than encourage companies to start buying services for the first time.

Finally, the two remaining objectives intend to address networking and cognitive failures. These objectives are to help firms gain access to scientific and technological knowledge, to networks and resources at national and international level, and to support the sharing of equipment and of research and development, testing and certification labs. These are achieved through a range of activities that include the organisation of networking, information, dissemination and training events, as well as the support in the preparation of research proposals. However, no specific indicator was provided by the regional government with respect to these activities. This important limitation of the regional indicators, which was also stressed by the poles' managing organization in our online survey, might have been discouraged poles from performing such activities.

Lack of satisfaction with indicators used to assess the poles' performance in order to allocate public funding was shared by the innovation poles themselves. Besides the limitations already discussed, the focus group participants highlighted two main critiques to indicators used for policy evaluation.

First, some indicators were deemed unsuitable to evaluate the poles' performance in several key activities. On the one hand, the focus group participants suggested

that the performance indicators for knowledge and technology mapping activities were too simplistic. In particular, mapping includes a complex set of activities, whose evaluation would have required more sophisticated measures including, among others, the presence of follow-up activities after each initial contact (indicating that the contact had been productive). On the other hand, some survey respondents noted that the services provided were not differentiated according to their quality and impact; for example, research provided as part of a large scale research project would have much greater knowledge content than an ordinary prototyping service. Differentiating between services with different knowledge intensity, the poles argued, would have allowed the policymaker to apply different weights to different services, and to better capture their different impacts.

Third, while the poles belonged to very different sectors (where organisations differed in terms of size, research intensity, technologies and modes of innovation, demand, localisation and structure of the value chain, and relationships with competitors), these sectoral specificities were not accounted for.

In order to analyze whether the indicators have produced distortive effects, we consider a number of indicators that are listed in the last column in Table 8, and discussed in the following subsection.

Table 8. Policy objectives, system failures, current indicators and their possible distortive effects

<b>Policy objective, as stated in policy documents</b>	<b>Types of system failures addressed</b>	<b>Type of activity carried out by the innovation poles</b>	<b>Indicators used by the regional government</b>	<b>Possible distortive effects</b>	<b>Empirical analysis of possible distortive effects</b>
To promote and meet the demand for innovation of the firms that are members of the poles, and, more generally, of all the SMEs in the poles' target sectors	Information failures, awareness failures	Marketing to recruit new members Knowledge and technology mapping to new member firms	Increase in number of members  Knowledge and technology mapping to new member firms	Poles chose companies that were easy to reach or that already had a propensity to innovation (to easily reach the target)	- How many of the member companies were known to the poles beforehand by having participated together in previously funded activities? - How many of the scouted companies were known to the poles beforehand by having participated together in previously funded activities? - How many of the scouted companies were innovative firms?
To help firms access high value-added knowledge-intensive services, in order to promote the diffusion of innovation across pole members and with external firms	Managerial failures	Direct provision of knowledge-intensive services, and intermediation in the provision of knowledge-intensive services	Number of services offered (provided, revenue)	Poles recruited members but did not do anything with them (they only recruited them to meet the numbers target)  Poles provided services to firms that were already used to buy services (and not to the other types of firms)  Poles provided services to more innovative firms (and not to the other types of firms)	How many of the poles' members were active in demanding services or were otherwise engaged with the poles?  How many of the services offered by the poles were provided to companies that had already bought services on the previous policy?  How many of the services offered by the poles were provided to most innovative firms?
To help firms gain access to scientific and tech knowledge, and to networks and resources at national and intl level To support the sharing of equipment and certification labs.	Networking failures, cognitive failures	Organization of training and other informational or educational events Organization of knowledge transfer activities; support in the preparation of R&D project proposals and direct participation in R&D projects	--	Poles do not provide these activities (or put a very little effort in providing such activities) because they are not relevant to assess their performance	How many of the poles' members were involved in educational events or in other activities carried out by the poles?

## **5. Empirical analysis of potential distortive effects**

In what follows we provide a tentative analysis concerning the existence of possible distortive effects of performance-based indicators. We refer again to the three main groups of indicators listed in Table 8, and we calculate the indicators put forward in the last column.

### **Distortive effects of indicators related to the first objective**

Recruiting members among companies that are easy to reach and mapping their needs. To check whether poles recruited and provided mapping services to firms that were easy to reach, for example those they were already working with, rather than focus on bringing new firms into their networks, we investigate how many of the member companies and of the mapped companies were known to the poles beforehand by having participated together in previously funded activities.

To determine how many member firms had already worked with the poles' managers, we use information that we gathered from archives related to previous regional policies. We found that, on average, 20.3% of member firms had already cooperated with the poles' managing organisations in previous policies that supported R&D collaborations. This percentage increases to almost 50% for Optoscana, a pole managed by organisations that had been very active in the 2000-2006 policies, and decreases to 3.8% for Penta, whose leading organisation (Navigo) was not involved in the 2000-2006 policies. During the overall period of activity, the poles' managing organisations continued to attract firms that had been their partners in previous policies, but at a decreasing rate.

### **Distortive effects of indicators related to the second objective**

Member recruitment without further activity. To check whether poles simply recruited members without intending to work closely with them but just to achieve their targets, we calculated how many of the member firms did not buy any services from the poles, and did not engage in any activity intermediated by the poles.

On average, the poles have been able to involve only 2 member firms out 10 in some innovation-related activities, while the remaining 8 firms have been

contacted only to become member of the poles, without being subsequently involved in any activity. In particular, out of the 3066 member firms, only 586 firms bought some innovation service offered directly by the poles of which they were members (19.1%). A further 75 firms bought services from the poles without being members.

Providing services to companies that were already accustomed to demanding them, or to most innovative firms.

Of the 586 companies that bought services from the poles, 206 companies (35.2%), had already benefited from a public incentive to buy knowledge intensive services, before the poles were created, and 34 of these (5.8%) were already active in the 2000-06 regional innovation policies.

The following table 9 summarizes the extent to which poles offered services to member firms that had already requested services from the previous policy before requesting them from the poles. The table shows that on average over a third (35.2%) of the member firms to which poles provided services had already been accustomed to requesting services beforehand. These firms accounted for 27.2% of the services provided and 42.7% of the value of these services. So these firms on average demanded more expensive services. The variability between poles is however very high.

**Table 9. Service provision to member firms that were already accustomed to demanding services**

Member firms that had already requested services from the previous "bando servizi" before requesting them from the poles:				
		Number of firms, as a share of member firms	Number of services provided, as a share of services provided to member firms	Value of services provided, as a share of the value of services provided to member firms
OPTOSCANA	1	22.2%	20.6%	1.3%
INNOPAPER	2	25.7%	8.3%	28.9%
OTIR 2020	3	43.8%	47.1%	79.4%
VITA	4	12.5%	8.8%	17.9%
PIETRE	5	-	-	-
PENTA	6	27.3%	34.5%	47.3%
POLIS	7	45.8%	48.6%	57.1%
NANOXM	8	36.4%	40.0%	33.8%
CENTO	9	36.2%	43.7%	58.4%
PIERRE	10	28.6%	25.4%	28.1%
POLO12	11	28.4%	24.9%	42.6%
POLITER	12	45.5%	45.5%	53.6%
average		35.2%	27.2%	42.7%

In addition, we found that 60% of the firms that received services from the poles were innovative firms, i.e. in the years before the start of the policy they were used to carry out either internal R&D activities or external R&D in collaboration with other organisations, while this percentage drops to 10% in the group of member firms that do not buy any services.

Distortive effects of indicators related to the third objective

Avoiding activities that are not included in the performance-based indicators.

The results of our survey on poles' managing organisations tells us that 11 poles out of 12 claim to have carried out various activities in order to support member firms' access to scientific and technological knowledge, and to networks and resources at national and international level. However, about 40% of the member firms interviewed claim to have been contacted by the poles only once, in order to become poles' members.

The figures reported suggest that the indicators used for performance-based funds allocations had some undesirable effects on the poles' behaviour. The indicators on the number and percentage increase of member firms were instrumental to the policy objectives to promote and meet the demand for innovation of member firms, and to encourage them to gain access to scientific and technological knowledge, networks and resources, and equipment and of research, development testing and certification labs. However, the majority of the member firms (8 in 10) did not demand any knowledge intensive services. Moreover, 40% of the member firms were contacted only to become members, without being involved in any subsequent innovation-relation activities. The indicators on the number and value of service providers were instrumental to the objectives to help firms access high value-added knowledge-intensive services, in order to promote the diffusion of innovation. However, not only most of the member firms did not demand services at all, but of those that did, about a third had already demanded services from the previous policy, so the poles' intervention may not have been necessary for these firms.

## **6. Towards a better approach to evaluating the performance of innovation intermediaries**

Indicators used to support the allocation of public funds should privilege clarity, ease of construction and use: they should be few in number, simple, linked to the intermediaries' key activities, and they could be expressed in terms of minimum thresholds to be achieved. When evaluation processes are based exclusively upon quantitative indicators, there is always a risk that such indicators might be pursued for their own sake, rather than as instruments to achieve broader objectives, and that targeting one's behaviour to these indicators might prevent or hamper the achievement of these broader objectives. Therefore, indicators should have a direct link to one or more explicitly defined policy objectives, and their construction should always be accompanied by a reflection on what behavioural incentives they might generate, in order to avoid the creation of incentives that are misaligned with the broader objectives that the policy intervention intends to serve.

In order to comprehensively evaluate the poles' performance in light of their objectives to remedy system failures, ultimately strengthening the competitiveness of the regional innovation system, while avoiding the creation of undesirable behavioural incentives, a wide range of indicators should be adopted.

First, we distinguish between (direct and indirect) outputs and (performance and behavioural) outcomes. Output indicators refer to the number of firms supported, as well as to the events and services provided by the intermediary. Outcome indicators refer to the observed effects of the outputs on the beneficiary firms: they aim to measure whether the firms have significantly changed their behaviour in line with the policy objectives. These could include changes in their internal innovation behaviour (measured, for example, on the basis of changes in: their demand for different types of knowledge-intensive services; the nature and types of their investments in innovation, including their investment in human resources and other intangibles; the nature and value of the research project proposals they submitted and for which they received funding; their innovation strategies) and changes in their collaborative innovation (e.g. networking) behaviour (changes in: the size and composition of their networks of relationships; the number and types of collaborative projects they engaged in). Outcomes can be evaluated not just descriptively but also through the counterfactual tools of the so-called



econometrics of program evaluation (Imbens and Rubin, 2015). However, the application of these tools to the field of intermediaries' activities is still in its infancy (see Knockaert et al., 2014).

The following Table 10 summarizes the possible measures for the evaluation of the poles' performance. The proposed measures are classified by policy objective, and corresponding system failures, and by their type (direct output, indirect output, or outcome indicators).

Based on our empirical evidence, we argue that, in order to evaluate how public funds were used, the regional government could have relied on specific set of indicators defined ex ante by the intermediaries themselves to capture their sectoral/technological specificity. Moreover, the regional government could have adopted a broader range of indicators, such as those reported under "direct and indirect outputs" as "proposed indicators" in Table 10. The indicators could be differentiated according to the objectives of the different poles in terms of what system failures they intend to prioritize. Especially when the results of the evaluation are used to decide whether to grant additional funding to the intermediary, it is important that indicators are clear, synthetic and have unambiguous meaning.

**Table 10. Policy objectives, system failures and proposed indicators**

<b>Policy objective, as stated in policy documents</b>	<b>Types of system failures addressed</b>	<b>Type of activity carried out by the innovation poles</b>	<b>Proposed indicators</b>
<b>To promote and meet the demand for innovation of the firms that are members of the poles, and, more generally, of all the SMEs in the poles' target sectors</b>	Information failures, awareness failures	Knowledge and technology mapping	Direct output: Number of new companies scouted Indirect output: Number and value of follow-up activities carried out (by the innovation intermediary or intermediated by it) Indirect output: Number of companies (by sector, size) that were offered mapping services, that engaged in follow-up activities with or intermediated by the innovation intermediary Outcome: Changes in internal innovation behaviour: nature and types of investments in innovation; nature and value of the research project proposals submitted and funded; types of innovation strategies
<b>To help firms access high value-added knowledge-intensive services, in order to promote the diffusion of innovation across pole members and with external firms</b>	Managerial failures	Direct provision of knowledge-intensive services, and intermediation in the provision of knowledge-intensive services	Direct output: Number and value of services provided or intermediated by the innovation intermediary (by type of service) Direct output: Number of companies (by sector, size) receiving services directly provided or mediated by the innovation intermediary (by type of service) Indirect output: Number and value of follow-up activities carried out (by the innovation intermediary or intermediated by it) Indirect output: Number of companies (by sector, size) involved in services provided or intermediated by the innovation intermediary, that engaged in follow-up activities with or intermediated by the innovation intermediary Outcome: Changes in the demand for knowledge-intensive services
<b>To help firms gain access to scientific and technological knowledge, and to networks and resources at national and international level</b> <b>To support the sharing of equipment and of research, development testing and certification labs.</b>	Networking failures, cognitive failures	Organisation of seminars, workshops, training and other informational or educational events Organisation of knowledge transfer programmes, technical tables, open days to facilitate knowledge sharing and networking between members Support in the preparation of R&D project proposals and direct participation in project proposals and direct participation in R&D projects	Direct output: Number of events held (by type of event) Direct output: Number of companies (by sector, size) participating in events (by type of event) Indirect output: Number and value of follow-up activities carried out (by the innovation intermediary or intermediated by it) Indirect output: Number of companies (by sector, size) involved in events, that engaged in follow-up activities with or intermediated by the innovation intermediary Outcome: Changes in networking behaviour: size and composition of networks of relationships; number and types of collaborative projects

## **7. Conclusion**

Adopting an analytical approach based on system-based failures, we have made a first attempt to analyze the potential distortive effects of a policy aimed at supporting innovation intermediaries.

In recent years, policymakers have placed growing trust in the activity of intermediaries. Intermediaries should stimulate the innovative capacity of firms, especially those that are not able to express their demand for innovation support, find new partners to work with, new knowledge and new technologies. In addition, they could play an important role in strengthening the connections between the agents that are part of the innovation system. However, if their incentives are not aligned to the pursuit of these objectives, there are few reasons to believe that these objectives will be achieved.

While evaluation exercises often analyse whether the intermediaries' behaviour was in line with the stated aims of the policy, very rarely they seek to understand the extent to which this behaviour was affected by the policy design. Our work has made a first attempt to bring to light the possible distortive effects of indicators that are not fully in line with the policy's objectives.

We found evidence in support of the fact that the policy we observe has produced a distortion in incentivising the poles to focus on some targets and not on others, and in providing support to those companies that do not necessarily needed them. We will explore these first results with further analysis. However, we want to stress two issues that have been implicitly raised by our analysis. First, that the performance-based indicators we analysed seem to have generated some distorted incentives does not mean that the policy as a whole was ineffective. In fact, we analysed a particular aspect of the policy but, for instance, we have not assessed whether intermediaries provided effective support to those firms that did receive services. Second, establishing performance-based indicators is very important, although not always easy. Indeed, this activity is constrained by the presence of an inner tension between two different forces. On the one hand, by setting too rigid indicators the policymaker can stimulate the funded agents to search the safest strategy to achieve them in time. As suggested by the case we analyse, this can incentivize the funded agents to focus on strong companies that more easily and quickly will help them achieve the target. On the other hand, by defining too loose indicators, the policymaker runs the risk that public money is spent inefficiently.

To achieve a balance is necessary to consider a wide range of indicators, such as, for example, those that we define in the Table 10, which are strongly connected with the policy objectives.

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