2. Innovation intermediaries as a response to system failures: creating the right incentives

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2.1 INTRODUCTION

Innovation intermediaries, that is, intermediary organisations that support firm-level and collaborative innovation (henceforth: intermediaries), are a varied set of organisations that provide either networking services (e.g. support to R&D partnership formation and to university–industry collaborations) or other knowledge-intensive services (e.g. knowledge and technology mapping, various types of consultancy) or both (Bessant and Rush, 1995; Hargadon and Sutton, 1997; Den Hertog, 2000; Howells, 2006; Wagner et al., 2014). Since 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 and technology transfer within local, regional and national innovation systems (Kauffeld-Monz and Fritsch, 2013). In particular, as we will argue in this chapter, the range of activities that intermediaries engage in can potentially address numerous failures in their innovation systems (Klein Woolthuis et al., 2005).

A number of policies around the globe have targeted intermediaries (Martin et al., 2011; Uotila et al., 2012; Knockaert et al., 2014; Fiordelmondo et al., 2014). However, policymakers can very rarely directly mandate the activities of intermediaries (which are usually private or public–private organisations or partnerships), so they need to create appropriate incentives for intermediaries to

satisfactorily address the system failures they are called to confront. A frequently used instrument is the conditioning of public funding on the intermediaries' achievement of certain performance targets, measured through (usually quantitative) indicators. However, such incentives are likely to work only if there is close alignment between the indicators measuring the targets' achievement and the policies' intended objectives; hence, the identification of appropriate indicators is a complex operation that is crucial for a policy's success.

While a debate is emerging on how to evaluate intermediaries' performance (Dalziel and Parjanen, 2012; Knockaert et al., 2014), little research exists on the extent to which performance indicators, particularly when they drive the allocation of public funding, can induce intermediaries to address their innovation system failures. Literature has shown that performance indicators are usually designed heuristically, often based on past experience, rather than grounded theoretically (Sizer, 1979; Jesson and Mayston, 1990; Molas-Gallart and Davies, 2006). As a result, one can find 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 ineffective, not only because they provide a partial evaluation of performance, but also because they create an implicit incentive system that alters the behaviour of the assessed units (Langford et al., 2006; Rafols et al., 2012; Teixeira and Koryakina, 2013). This incentive system can produce undesirable effects if it is not fully aligned with the policy objectives (European Commission, 2013).

Our study aims to provide a theoretical framework to address the mismatch between the policies' objectives to address innovation system failures, on the one hand, and the indicators used to evaluate the intermediaries' performance, on the other. By suggesting that the measurement of the intermediaries' performance should be explicitly linked to their success in remedying such failures, this approach can then provide a guide to the design of appropriate indicators.

These issues are illustrated through a case study of publicly funded innovation intermediaries in the Italian region of Tuscany in 2011–2014. We show that the indicators used to allocate public funding induced the intermediaries to pursue behaviours that allowed them to reach their performance targets rapidly, but that were misaligned with the policy's ultimate objectives. We then argue that

performance indicators that addressed more directly the innovation system failures the policy intended to mitigate, would have been more appropriate and consistent with policy goals. The applicability of our findings goes beyond the case of Tuscany: not only other Italian regions adopting similar innovation policies have used similar sets of indicators to evaluate the performance of innovation intermediaries, but some of these indicators are among the most commonly used by policymakers around the globe (Comacchio and Bonesso, 2012; European Commission, 2013).

The chapter is structured as follows. Section 2.2 reviews the literature on system failures in relation to publicly funded innovation intermediaries and proposes a framework to conceptualise the intermediaries' objectives in terms of remedying system failures. Section 2.3 presents the background to the case study, and Sections 2.4 and 2.5 discuss the limitations and effects of the indicators used by the regional government. Section 2.6 proposes the use of a systems failure framework to improve the evaluation of innovation intermediaries by aligning indicators with policy objectives. Section 2.7 concludes.

2.2 A SYSTEMS FAILURE VIEW OF PUBLICLY FUNDED INNOVATION INTERMEDIARIES

2.2.1 Intermediaries' Activities in Addressing System Failures

While policies supporting innovation and technology transfer have been traditionally motivated by the need to address market failures in the private funding of research and development (R&D) (Abramovski et al., 2004), leading to the development of policy instruments like R&D tax credits, grants or innovation vouchers, in recent years system failure rationales have become more pervasive: policy interventions are increasingly aimed at addressing failures in the functioning of innovation systems, whether involving specific actors, their interactions, or the system's general infrastructures (Lundvall, 1992; Nelson, 1993; Edquist, 1997; Klein Woolthuis et al., 2005). System failure rationales appear to underpin most policies targeting innovation intermediaries, whose activities enable them to support different types of actors within their innovation system, to facilitate interactions between them and to provide certain kinds of infrastructural support. Indeed, we argue that intermediaries can potentially

address all main types of system failures, as identified by Klein Woolthuis et al. (2005): infrastructural, capability, interaction and institutional failures.

First, intermediaries can remedy failures in the information infrastructure of the innovation system (Malerba, 2009), by diffusing information about opportunities for collaborations with other actors (Bougrain and Haudeville, 2002), as well as about 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, 1995). These failures occur when firms do not know how to acquire useful knowledge or technologies, or how to usefully implement them into product and services. Moreover, actors may be unaware of what knowledge or technologies they are lacking (Brusco, 1992; Kaufmann and Tödtling, 2002), which is a form of 'awareness failure'. Through activities such as knowledge and technology mapping, innovation intermediaries can help actors gain awareness of what they need, in order to find the right way to obtain it.

Third, 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). This can be particularly helpful to 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 Leeuwis, 2009).

Finally, intermediaries can address the lack of formal or informal institutions supporting innovation. They can provide firms with information, advice or other services related to formal institutions (e.g. support with patent

search and patent licensing). Furthermore, they can facilitate the emergence of social norms that underpin good innovative performance, as when their support for collaborations promotes mutual trust.

Table 2.1 A system failures framework to conceptualise the key functions and related activities of publicly funded innovation intermediaries

General system failures categories	Specific system failures that can be addressed by intermediaries	Sources of system failure	Examples of innovation intermediaries' activities that can help solve system failures
Infrastructure failures	Information failures	Economic actors lack information about sources of external knowledge and opportunities	Diffusion of information about existing opportunities
Capabilities failures	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
	Awareness failures	Economic actors lack awareness of their own needs for information, knowledge, competences	Knowledge and technology mapping
Interaction failures	Networking failures	Economic actors lack connections between them, due to weak or strong network failure	Targeted introductions and meetings General networking Provision of interaction spaces
	Cognitive failures	Economic actors are unable to interact due to cognitive distance	Leading collaborative innovation projects Leading communication within interaction spaces Mobilizing resources for collective initiatives
Institutional failures	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 intellectual property rights) Direct provision of services related to formal institutions (e.g. support for applying for a licence or a certification) Lobbying activity towards policymakers to stimulate the creation of formal institutions Facilitating the emergence of social norms that promote collaboration

By integrating the main categories of system failures identified by Klein Woolthuis et al. (2005) and their descriptions, with the above-mentioned literature on intermediaries' activities, Table 2.1 summarizes the key system failures that innovation intermediaries can address, and the activities through which they may do so, with the ultimate objective to strengthen their innovation system.

2.2.2. Problems in the Definition of Incentives for Intermediaries

As the system failure framework provides an implicit or explicit rationale for public funding of innovation intermediaries, it is important for policymakers to create the appropriate incentives for intermediaries to properly address these failures. Linking the allocation of public funds to the achievement of performance targets, measured by indicators, is an increasingly common approach to attempt to incentivise intermediaries to act in accordance with policy objectives. Indeed, a vast literature has discussed how policymakers' choice of indicators can influence the behaviour of the funding recipients (Paton, 2003; Freeman and Soete, 2009). However, setting appropriate performance indicators is not an easy task. Most evaluation exercises rely on performance indicators that measure the production of specific outputs that are considered desirable, but little attention is paid to the behavioural incentives that these performance indicators create, in order to ensure that they are aligned with the policy objectives (Comacchio and Bonesso, 2012; European Commission, 2013).

Performance indicators should be complete, such as to cover all the relevant aspects of the policy. If this is not the case, intermediaries may aim for good performance scores in the indicators, disregarding other potentially important objectives, the attainment of some of which may not be easily measurable. Moreover, indicators should refer to the time span that is needed to achieve the desired results. Otherwise, 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.[1] Finally, and more generally, indicators should be aligned with the objectives that the policy intends to achieve. Most of the indicators that are used in practice refer to the *outputs* that intermediaries produce (Comacchio and Bonesso, 2012) (e.g. how many patents have they applied for, or have they facilitated? How many collaboration agreements have they signed? How many services have they provided?). Simply producing more outputs, however, is rarely the objective of innovation policy. Instead, policies aim to encourage intermediaries to remedy the sources of system failures: to improve the resources (information, networks) and capabilities (competences, skills) of the economic actors in the system, thus leading to changes in their behaviours and performance. Indicators therefore should be closely linked to the *outcomes* that the economic actors in the system achieve thanks to the activity of the intermediaries. It must be noted that, 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 use of outcome indicators in itself does not necessarily address the mismatch between the policy objectives and the indicators defined by policymakers: what matters is that these outcomes are aligned with those that the policy intends to achieve.

We rely on a case study to illustrate the implications of the misalignment between performance indicators and policy objectives, and to showcase an improved approach to performance evaluation. The case study concerns a policy intervention implemented by the Italian region of Tuscany in 2011–2014, through which the regional government funded 12 innovation poles, a particular type of innovation intermediary.

2.3 THE REGIONAL INNOVATION POLES

[1] See, for example, Gulbrandsen and Rasmussen (2012), who show how, in the case of the Forny technology transfer programme in Norway, the use of the number of spin-off companies as an indicator to determine the annual bonus payments for technology transfer offices led the latter to launch too many firms too early.

Since the constitutional reform introduced in the 2000s, Italian regions have been responsible for most enterprise and innovation policy, and Tuscany is one of the more proactive regions in this respect (Caloffi and Mariani, 2017). Intermediaries have a long history in the region. They were first created in the 1960s as public–private organisations (not involving universities) to provide consulting services to Tuscany's many small firms. Many of them were specialised in some of the traditional 'made in Italy' sectors (footwear, jewellery, textiles and clothing), which were linked to the diffuse presence of industrial districts (Brusco, 1992). Others were specialised in high-tech emerging sectors such as robotics. Many intermediaries were small in size, and lacked the minimum scale needed to efficiently provide enterprises with high quality services. Most of them received financial support from the regional government in order to provide a range of services to the SMEs. Over time, with the decreasing importance of some industrial districts and the increasing need for technological innovation even in more traditional sectors, many intermediaries have become more transversal in sectoral terms and have started to focus on innovation. In 2010, to accelerate the intermediaries' transformation, and strengthen their role in knowledge and technology transfer from university to industry, the region promoted the creation of innovation poles. This is the policy that we focus on in this study.

As a first step, in 2010 Tuscany's regional government identified a set of key technologies/applications and launched a call for tender inviting organisations to submit proposals for the creation of poles for a three-year period (2011–2014). Poles were consortia between universities and research centres, knowledge-intensive service providers and firms. Each consortium was led by a managing organisation that decided what services to provide and how to organise the poles' many activities. Firms that intended to use an innovation pole's services would have to gain membership of that pole.

For the first three years, the poles were experimental in character. Afterwards, having evaluated their accomplishments, the policymaker would then decide how to structure subsequent interventions in the field. Table 2.2 lists, for each innovation pole that had been selected for funding, its key technology/application, the number of organisations in the consortium and the number of members at the start (30.6.2011) and end (30.6.2014) of the three-year period.

The poles received regional funds to carry out the following activities:<nl>

1. marketing to recruit new members, including technology mapping activities to encourage firms to demand knowledge-intensive services and to invest in innovation;
2. direct provision of knowledge-intensive services;
3. participation in regional, national and European R&D projects, and organisation of knowledge transfer programmes, workshops and seminars to facilitate knowledge sharing and networking among members;
4. management of open access infrastructures such as research laboratories.</nl>

Table 2.2 Key technologies/applications, consortium participants, pole members

Innovation pole (acronym)	Key technologies/applications	No. consortium participants	No. members as of 30.06.2011	No. members as of 30.06.2014
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 (information and communication technologies) and robotics	13	195	697

Source: Our elaborations using data provided by Tuscany's regional government.

As a second step, the region provided some additional funds to encourage local firms to join the poles and participate in their activities: firms that bought

knowledge-intensive services, which were either directly provided or intermediated by the poles, would be given a subsidy equal to 80 per cent of the service's price.[2]

The policymakers expected the poles to expand the range of users of innovation services, particularly those SMEs that had little understanding of their needs and were unable to express a 'demand for innovation'. By recruiting new member firms and mapping their needs, the poles would help firms to find the most appropriate knowledge-intensive services. In turn, by gaining access to knowledge-intensive services, SMEs would improve their innovation capabilities, which would generate positive spillovers in the regional innovation system.

Public funding was allocated to innovation poles in two instalments: up to 70 per cent over 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:

1. percentage increase in the number of member firms;
2. number of member firms that were offered knowledge and technology mapping services;
3. number of services provided to firms, and revenue from the sale of services.

Table 2.3 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.

[2] This incentive existed before the creation of the poles: since 2008, SMEs could apply for public subsidies for the purchase of various types of knowledge-intensive services. The admission to the incentive was semi-automatic (it was based on compliance with a set of formal criteria, including company size) and granted a reduction in the range of 20–60 per cent on the cost of the service.

Table 2.3 Innovation poles' classification into bands: criteria, performance targets and maximum funding that could be claimed

	Criterion for allocation into bands:	Performance targets to be achieved within three years (minimum thresholds)				Maximum funding that could be claimed from the regional government
	No. member firms (at launch)	% increase in the number of member firms	No. firms to be offered knowledge and technology mapping services	No. firms to be offered knowledge-intensive services	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 €

Source: Our elaborations using data provided by Tuscany's regional government.

In what follows we discuss these indicators in the light of their capacity to promote the achievement of the policy's objectives, and we provide some evidence about the extent to which they induced behaviours that were misaligned with these objectives.

Our empirical analysis builds upon several data sources, which we assembled as part of a research team engaged in the analysis of the policy programme. The main source is administrative, as we collected information on poles' structure, activities and performance, as well as on poles' member firms, from the reports that were provided to us by Tuscany's regional government. Then, we performed a number of interviews with the policymakers managing the programme (in March and May 2014), the poles' managing organisations (an online survey in March–April 2015 and a focus group in May 2015),[3] and the poles' member firms.

[3] The first email inviting the managing organisations to take part in the survey was sent on 27 March 2015, followed by two recalls sent to non-respondents only. Fourteen (30 per cent) out of the 46 managing organisations responded 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.

2.4 LIMITATIONS OF THE INDICATORS USED BY THE REGIONAL GOVERNMENT

In order to detect any mismatch between policy objectives and the performance indicators that were established by the regional policymaker, we review the indicators in light of the objectives stated in the policy documents (Regione Toscana, 2010) (Table 2.4). Then, in what follows, we put forward the consequences of this misalignment for the poles' incentives to address system failures.

The first objective – to promote and meet the demand for innovation on the part of local firms, particularly SMEs and more fragile firms, which are not able to express such demand – referred to awareness problems that could prevent SMEs from identifying their main needs and devising appropriate strategies to satisfy them. Here, the reference to specific system failures was clearly outlined. The policymaker defined two indicators (minimum percentage increase in number of members and in the 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. However, these indicators did not capture whether and to what extent the poles had been successful in solving the information and awareness failures that could affect local firms. These indicators may even have undermined the attainment of this objective since, in order to easily reach the target, poles could have chosen to approach firms that were easy to reach (e.g. firms that were known beforehand to the poles) rather than the most fragile firms, with greater awareness problems.

The second objective – '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' (Regione Toscana, 2010) – was to address, and possibly solve, managerial failures. The remaining two indicators (minimum number of firms to be offered knowledge-intensive services, and minimum revenue from the sale of services) may be related to this policy objective. However, also in this case the indicators were not directly measuring whether the poles had been successful in addressing managerial failures in regional firms, and, indeed, the indicators may have undermined the attainment of the second objective: in order to easily reach the targets, poles could have provided services to firms that were more willing to buy services (e.g. to

firms that were already buying services, or to more innovative firms) rather than to firms with managerial problems.

Table 2.4 Comparison between policy objectives and performance indicators

Policy objective	Type of system failure addressed	Performance indicators
Poles should promote and meet the demand for innovation, particularly in SMEs and more fragile firms who were unable to express such demand	Information failures Awareness failures	% increase in number of members Minimum number of new member firms to be offered knowledge and technology mapping services
Poles should expand the number of firms accessing high value-added knowledge-intensive services	Managerial failures	Minimum number of firms to be offered knowledge-intensive services Minimum revenue from the sale of services
Poles should help firms gain access to scientific and tech knowledge, and to networks and resources at national and international level Poles should support the sharing of equipment and certification labs	Networking failures Cognitive failures	–

The policymaker also had two other objectives. However, no performance indicators were set that could be linked to those. As a consequence, poles could

have chosen not to perform these activities (or to put very little effort into them) because they were not relevant to their performance evaluation.

In what follows, we focus on the empirical analysis of the potentially misaligned incentives created by performance indicators, while in Section 2.6 we reflect on process and outcome indicators that could be used to support intermediaries in addressing system failures.

2.5 MISALIGNMENT BETWEEN POLES' INCENTIVES AND POLICY OBJECTIVES

Even a quick glance at the poles' performance suggests that the targets were probably too low, given that most poles reached them very rapidly. This can be seen in Table 2.5, which summarises the results achieved by each innovation pole in the period 2011–2014, ordered by band, and highlights with an asterisk those cases in which the targets had been reached in less than half the time allocated to these activities.

All poles reached at least one of their performance targets within the first six months, and most of them had reached at least two targets within the first year. Moreover, all poles had reached all of their performance targets within two years. While the targets could have been easy to reach in an absolute sense, this might suggest the presence of incentives for the poles to act in ways that were misaligned with the policy's objectives: innovation poles may have strategically implemented actions aimed at achieving the targets, regardless of whether such actions were aligned with their ultimate objectives to address failures in the innovation system.

To assess whether this might have been the case, we investigated several ways in which performance indicators might have affected the behaviour of the innovation poles. In order to do so, we tried to define some very simple indicators that can be used to identify the potential misalignment between the poles' incentives, on the one hand, and the policy objectives put forward in Table 2.4, on the other.

Table 2.5 Performance targets and their achievement

Innovation pole	% increase in the number of	Firms with knowledge and	Services provided	Revenue

	member firms (above the minimum initial threshold for each band)	technology mapping		
	%	no.	no.	€
Minimum target for Band 1	50	160	40	500,000
Poles' final performance				
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*
Minimum target for Band 2	50	80	20	300,000
Poles' final performance				
INNOPAPER	73*	94	455*	711,608*
PIERRE	363*	120	64*	1,082,638*
Minimum target for Band 3	50	40	10	150,000
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: * Poles that achieved the target within the first three semesters of activity.

*Sourc*e: Our elaborations using data provided by the innovation poles to document their performance, reference period: 1 July 2011–30 June 2014.

2.5.1 Misaligned Incentives of Indicators Related to the First Objective

Recruiting members among firms that were 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 had already worked with prior to the policy programme, rather than focus on firms that were outside their established networks, we investigated how many of the member firms had participated together with the poles in previously funded activities. Based on information gathered from archives related to previous regional policies that supported R&D collaborations, we found that, on average, 20.3 per cent of member firms had already cooperated with the poles' managing organisations.

Member recruitment without further activity

To check whether poles simply recruited members without intending to work closely with them, but just to achieve their membership 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 involved only two member firms out of ten in some innovation-related activities, while the remaining eight firms were contacted only to become members, without being subsequently involved in any activity. In particular, out of the 3,066 member firms, only 586 firms bought some innovation service offered directly by the poles of which they were members (19.1 per cent). A further 75 firms bought services from the poles without being members.

2.5.2 Misaligned Incentives of Indicators Related to the Second Objective: Providing Services to Firms that Were Already Accustomed to Demanding Them, or to the Most Innovative Firms

If we consider only the 586 firms that bought services from the poles, 206 firms (35.2 per cent) had already benefited from a public incentive to buy knowledge-intensive services, before the poles were created. These firms accounted for 27.2 per cent of the services provided and 42.7 per cent of the value of these services. So, on average, these firms demanded more expensive (which generally meant more complex and more knowledge-intensive) services. It is also interesting to observe that, of the 206 firms that had already requested services from the previous policy programmes, almost half (92, that is 15.7 per cent of the set of firms that bought services from the poles) 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.

In conclusion, 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; for half of these firms, the poles simply crowded out other services providers instead of providing different services.

2.5.3 Misaligned Incentives of Indicators Related to the Third Objective: Avoiding Activities Whose Performance Was Not Measured by Indicators

Our survey of the poles' managing organisations suggests that 11 poles out of 12 carried out 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 per cent of the member firms that we interviewed claimed to have been contacted by the poles only once, to recruit them as members.

Based on this information, poles seem to have put little effort into performing these activities, even if they were required to achieve some policy objectives. Therefore, also in this case, the indicators (or lack thereof) seem to have produced misaligned incentives.

Summarising, through our empirical analysis we found some evidence that the poles adopted behaviours that were misaligned with the policy's objectives. Most member firms (eight out of ten) did not demand any knowledge-intensive services. Moreover, 40 per cent of the member firms were contacted only to become members, without being involved in any subsequent innovation-related activities. Of the member firms that demanded services, about a third had already demanded services from the previous policy, so the poles' intervention may not have been necessary for them, and may have even crowded out other existing providers.

2.6 TOWARDS A BETTER APPROACH TO EVALUATING THE PERFORMANCE OF INNOVATION INTERMEDIARIES

The performance indicators used by the regional government had several limitations. First, they were incomplete because they only focused on some of the poles' activities. Second, they were not explicitly designed to support the achievement of policy objectives. Much of the recent debate on the evaluation of intermediaries' performance focuses on 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. However, while the use of outcome indicators is crucial in order to understand the overall effects of the policy programme, it might not in itself correct the misalignment between the incentives created by the indicators and the policy's objectives, if the

indicators are not aligned with the latter. Instead, we argue that the key problem when defining performance targets and performance indicators (especially, but not only, when they are used to allocate public funding) is to closely align such indicators with the policy's objectives.[4]

Building on the system failures framework outlined in Table 2.1, and on findings from our case study, we derive some implications for the development of performance indicators that can effectively incentivise intermediaries to address system failures in their innovation system.

First, policymakers should identify the full range of intermediaries' activities and pay particular attention to those that are instrumental in addressing the key failures, thus avoiding the omission of important activities from the evaluation just because they are less visible or less easy to measure. This addresses a very common problem in performance measurement (Robichau and Lynn, 2009; Rossi and Rosli, 2015). In the case of Tuscany, focusing on the full range of intermediaries' activities directed at addressing system failures would have entailed including additional indicators relating to networking and sharing of laboratories and equipment.

Second, performance indicators should be clearly linked to policy objectives (European Commission, 2013). Output indicators should be defined carefully in order to precisely capture policy objectives; for example, in the case of Tuscany, rather than measuring the overall number of organisations the intermediary provided services to, the indicator should have only focused on organisations that had not previously demanded services, with a clear link to the policy objective to 'expand the number of firms accessing high value-added knowledge-intensive services'. Outcome indicators should measure whether, thanks to the intermediaries' activities, the economic actors in the innovation system have acquired resources (information, services, contacts) and engaged in learning processes that have allowed them to improve their capabilities to engage

[4] It must be remarked that although the performance-based indicators we analysed seem to have generated some misaligned incentives, this does not mean that the policy as a whole was ineffective. Establishing this would have required an appropriate *ex post* evaluation, possibly including a counterfactual analysis.

in innovation (e.g. through better communication and negotiation skills, greater awareness of their own abilities and limitations, greater understanding of the process of collaboration, greater trust and openness towards external collaborations) which in turn have led to changes in their behaviours (e.g. greater networking activity, changes in the types of partners they interact with, changes in the type of innovation processes they perform) and possibly in their performance (more innovation, greater profitability and so on). In the case of Tuscany, outcome indicators could have measured whether regional firms had changed their behaviours (e.g. greater networking activity, changes in the types of partners they interacted with, changes in the type of innovation processes they performed) and possibly their performance (more innovation, greater profitability and so on), thanks to the poles' activities.[5] Table 2.6 summarizes such possible indicators. The proposed measures are classified by policy objective, and corresponding system failures, and by their type (direct output, indirect output, or outcome indicators).

Table 2.6 Policy objectives, expected outcomes and proposed indicators

Types of system failures addressed	Proposed direct and indirect output indicators	Proposed outcome indicators
Information failures, awareness failures	Number of new (not previously known) firms recruited Number of new (not previously known) firms mapped Number and value of follow-up activities carried out with the firms recruited Number of new firms that were offered mapping services, that engaged in follow-up activities	Changes in firms' 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
Managerial failures	Number and value of services provided or intermediated by the innovation intermediary to firms that had not demanded that kind of services before, or that had never demanded services Number of firms receiving services	Changes in firms' demand for knowledge-intensive services: number of firms demanding services; number of services demanded

[5] 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 just descriptively but also causally, through the counterfactual tools of the so-called econometrics of programme evaluation (Imbens and Rubin, 2015). However, the application of these tools to the field of system failures is still in its infancy.

	directly provided or mediated by the innovation intermediary that had not demanded that kind of services before, or that had never demanded services	
	Number and value of subsequent services provided to these firms	
	Number of firms receiving services that requested further services	
Networking failures, cognitive failures	Number of events held (by type of event)	Changes in firms' networking behaviour: size and composition of networks of relationships; number and types of collaborative projects
	Number of firms participating in events	
	Number and value of follow-up activities carried out with these firms	
	Number of firms involved in events, that engaged in follow-up activities	

2.7 CONCLUSIONS

In recent years, policymakers have relied on intermediaries to stimulate the innovative capacity of firms (especially those that are not able to express their demand for innovation), to find new partners to work with, new knowledge and new technologies. In addition, intermediaries can play an important role in strengthening the connections between actors within an innovation system. However, if the intermediaries' 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 do they seek to understand the extent to which this behaviour was affected by the policy design. Our study attempted to bring to light the possible misaligned incentives created by indicators that were not fully in line with the policy's objectives; it found that the policy had incentivised the innovation intermediaries to focus on some activities and not on others, and to provide support to firms that did not necessarily need it.

Building on a theoretical framework linking intermediaries' activities to the remedy of system failures and on the analysis of our empirical evidence, we derive some general policy implications that go beyond the specific case we studied.

First, in order to create incentives for innovation intermediaries to properly address innovation system failures, the latter should be identified clearly, by

rewording policy objectives in terms of system failures. All policy objectives and all important activities performed by the intermediaries should be considered, without neglecting some just because they are less visible or less easy to measure.

Second, indicators should be clearly linked to policy objectives: traditional output indicators should be carefully reconsidered, in order to clearly mirror policy objectives, and they should also be accompanied by outcome indicators measuring whether the economic actors targeted by the policy had changed their behaviours and possibly their performance thanks to the activities performed by the intermediaries (as in the example presented in Table 2.6).

Finally, attention should be paid to trade-offs. By setting indicators that are simple to compute and not too demanding in terms of data requirements, the intermediaries only need to invest a limited amount of resource in the evaluation process, and can engage in more productive activities instead. But indicators are often too loosely related to the policy's ultimate objectives to address failures both at firm level and at system level. To achieve a balance it is necessary to ensure that a link between indicators and policy objectives is maintained even as indicators are kept as simple as possible. For example, in some cases the collection of outcome indicators may prove too costly, or outcomes may only become apparent after an extensive length of time whereas performance measurement needs to be done relatively quickly. In such cases, the indicators may focus only on output measures of intermediaries' performance: as long as these output indicators are strongly connected with policy objectives (as in the example presented in Table 2.6), they may be sufficient to incentivise intermediaries to effectively address system failures.

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