



Measuring Business Excellence

Assessing performance and impact of the Technological Districts (TDs): general modelling and measurement system

Antonio Lerro Giovanni Schiuma

Article information:

To cite this document:

Antonio Lerro Giovanni Schiuma , (2015), "Assessing performance and impact of the Technological Districts (TDs): general modelling and measurement system", *Measuring Business Excellence*, Vol. 19 Iss 3 pp. 58 - 75

Permanent link to this document:

<http://dx.doi.org/10.1108/MBE-04-2015-0023>

Downloaded on: 17 August 2015, At: 01:16 (PT)

References: this document contains references to 53 other documents.

To copy this document: permissions@emeraldinsight.com

The fulltext of this document has been downloaded 5 times since 2015*

Access to this document was granted through an Emerald subscription provided by

Token: JournalAuthor:B38EE8A7-830A-497A-8B42-8A14C93E82D7:

For Authors

If you would like to write for this, or any other Emerald publication, then please use our Emerald for Authors service information about how to choose which publication to write for and submission guidelines are available for all. Please visit www.emeraldinsight.com/authors for more information.

About Emerald www.emeraldinsight.com

Emerald is a global publisher linking research and practice to the benefit of society. The company manages a portfolio of more than 290 journals and over 2,350 books and book series volumes, as well as providing an extensive range of online products and additional customer resources and services.

Emerald is both COUNTER 4 and TRANSFER compliant. The organization is a partner of the Committee on Publication Ethics (COPE) and also works with Portico and the LOCKSS initiative for digital archive preservation.

*Related content and download information correct at time of download.

Assessing performance and impact of the Technological Districts (TDs): general modelling and measurement system

Antonio Lerro and Giovanni Schiuma

Antonio Lerro is a Research Fellow at the Department of Engineering for Innovation, University of Salento, Lecce, Italy and Department of Mathematics, Computer Sciences and Economics, University of Basilicata, Potenza, Italy.
Giovanni Schiuma is Professor at the Department of Mathematics, Computer Sciences and Economics, University of Basilicata, Potenza, Italy.

Summary

Purpose – This paper aims to define a general model to identify and assess performance and impacts of the technology districts (TDs), paying great attention to avoid confusion on contents and methods as well as overlapping of economic, financial and managerial dimensions of performance and impact that often have characterized the academic and policy literature. Although over the past years the emphasis on knowledge and science-based resources has strongly contributed to create a wide acknowledgement of the relevance of the TDs for the national and local development paths, there is still a need for a better understanding about the assessment of the TDs' performance and impacts.

Design/methodology/approach – First, a literature review – both at academic and practitioners' and policy level – was performed using a systematic approach. Then, a rigorous Delphi methodology was designed and implemented to identify and select the most important issues of interest of the research by soliciting qualified experts.

Findings – Based on this research, a well-grounded set of macro-areas and specific indicators aimed to assess performance and impact of the TDs is proposed from which researchers and policymakers can choose those which are more fitted to the needs of their studies and as a way to define the specific focus of their investigation.

Practical implications – The definition of this general model has the objective to support the elaboration of a structured set of managerial and policy implications able to drive, respectively, the management in the strategy formulation and implementation, as well as in the actions for the performance improvement, and the decision-makers in the elaboration of effective policies of development and correct evaluation of the impact of the TDs on the different places.

Originality/value – This paper contributes at theoretical and practical level to improve the managerial and policy methods and tools to identify, assess, manage and report the performance and the impact of the TDs. The originality and the value of the paper resides in its attempt to improve and to let more shared and transparent the informative quality on which the TDs are called to operate and report to the stakeholders, in particular regulators and public organizations. Moreover, this paper will hopefully stimulate a debate and encourage a greater level of clarity, generalizability and comparability in the TDs performance measurement systems research stream.

Keywords Performance, Impact, Modeling, Indicators, Delphi analysis, Technology districts

Paper type Research paper

1. Background

The global economy is changing at an unprecedented rate: science, technology, knowledge and innovation are at the hearth of these transformations, not only because technology is itself a key driver of globalization but also because national and regional systems will increasingly derive their competitive edge from the speed with which they are able to innovate (Cooke and Morgan, 1998; Lerro and Schiuma, 2011; Moulart and Sekia, 2003; Schiuma and Lerro, 2008; Simmie, 2005).

To create major attractiveness as a location for research, science and innovation, recently different national and regional systems have decided to build a new strategy to face the global challenge based on the creation of specific and right “ecosystems” able to connect world-class science base, advanced knowledge and business (Iammarino and McCann,

Received 24 April 2015
Revised 24 April 2015
Accepted 20 May 2015

2006; Maillat, 1995; Maskell, 2001; Pinch *et al.*, 2003; Sennett, 2001; Tallman *et al.*, 2004). In particular, different territorial systems around the world view knowledge, innovation and networking capacity as keys to achieve development and economic prosperity, and adjust their endogenous development strategies increasingly by visioning the ultimate goal of knowledge-based development. (Arundel and Geuna, 2004; Baptista and Swann, 1998; Lerro, 2014; Leydesdorff and Meyer, 2006; Owen-Smith and Powell, 2004).

Accordingly, the design and the creation of *technology districts* (TDs) have gained increasing popularity and are emerged as key drivers to activate and support operatively new knowledge-based development paths for national and local systems (Antonelli, 2000; Bonaccorsi and Nesci, 2006; Bottinelli and Pavione, 2011; Cesaroni and Piccaluga, 2003; Lazzeroni, 2010; Storper, 1992).

Although over the past years the emphasis on knowledge and science-based resources has strongly contributed to create a wide acknowledgement of the relevance of the TDs for the national and local development paths, there is still a need for a better understanding about the assessment of the TDs' performance. As most of the TDs' activities and policies have been conducted quite recently, the performance of the TDs and the policy measures' impact still needs time to show up and be evaluated (Chen *et al.*, 2006; Eisingerich *et al.*, 2010; Freeman, 1987; German Institute for Innovation and Technology, 2011; Italian Agency for the Diffusion of the Technologies for Innovation, 2012; Siegel *et al.*, 2003; Spencer *et al.*, 2010; Van Looy *et al.*, 2006).

The aim of this paper is to elaborate a general model to identify and assess performance and impacts of the TDs, paying great attention to avoid confusion on contents and methods as well as overlapping of economic, financial, managerial dimensions of performance and impact that often have characterized the academic, practitioner-oriented and policy literature.

The paper proceeds as follows. The second section briefly analyzes theory and practice on TDs and then introduces the issues related to the importance to define performance frameworks and indicators assessing TDs' effectiveness and impact. The literature review on TDs' performance and impact systems and indicators, state-of-the-arts and gaps identification is presented and discussed in the third section. The fourth section deals specifically about methodology and findings. The fifth section presents implications for theory and practice, whereas the sixth section addresses limitations and future development of the research.

2. The notion of TDs and the importance of assessing TDs' performance and impact

More recently, there has been a wide debate in academic, economic and policy circles finalized to identify the "better" scale in which knowledge communities emerge and knowledge-based dynamics activate real development paths. The clustering of R&D activities, new technology creation and implementation, high-tech manufacturing of knowledge-intensive industrial and business sectors, relationships and networking among local, national and international stakeholders have been traditionally identified as key levers to activate and support these virtuous mechanisms (Iammarino and McCann, 2006; Lerro and Schiuma, 2009; Maillat, 1995; Maskell, 2001; Pinch *et al.*, 2003; Sennett, 2001; Tallman *et al.*, 2004).

According to this debate, Spencer *et al.* (2010, p. 698) state that "few constructs have enjoyed as much currency amongst both scholars and practitioners of regional economic development as the concept of the cluster", as well as underline the wide acknowledgement that the geographical clustering of industrial activity may provide for economic prosperity and growth. The literature on clusters is situated within a much broader body of work on the relations between innovation processes and territory, including proper clusters *a la*, industrial districts, local production systems and other

related concepts, which has been extensively reviewed in recent years (Arundel and Geuna, 2004; Baptista and Swann, 1998; Leydesdorff and Meyer, 2006; Owen-Smith and Powell, 2004; Lerro, 2014; Lerro and Schiuma, 2011; Moulaert and Sekia, 2003; Simmie, 2005).

Among these typizations, the creation and the development of TDs have gained an increased prominence among entrepreneurs, manager and policymakers, influencing the development strategies of local and national systems and luring the attention toward knowledge-based and technological industries as significant drivers of local and national growth. The economy of a TD creates high-value-added products and services using research, technology and brainpower. In a TD, private and public sectors value knowledge, invest in technology, integrate tangible and intangible assets and, ultimately, harness them to create innovative goods and services (Antonelli, 2000; Bonaccorsi and Nesci, 2006; Bottinelli and Pavione, 2011; Cesaroni and Piccaluga, 2003; Lazzeroni, 2010; Storper, 1992).

Although there is not yet a clear and shared identification and definition of “technology district” at economic theory level, and they have been often conceptualized as a modern and dynamic variant of the industrial districts, the same literature, together with the managerial one, has provided different perspectives of analysis and highlighted specific features characterizing a TD.

Regarding the definition of TD, after reviewing the literature involved in these issues (Bigliardi *et al.*, 2006; Bonaccorsi and Nesci, 2006; Bottinelli and Pavione, 2011; Grinstein and Goldman, 2006), and on the base of the definition of Cesaroni and Piccaluga (2003), a working definition of TD has been elaborated as a “form of collaborative networks where supply chains of corporations, small and medium enterprises (SMEs) and other economic and institutional actors – localized or not in spaces geographically well defined – are involved in projects and activities particularly rich in their industry-related knowledge domains, in which it is often possible to trace profiles of excellence both at the beginning of the supply chain in terms of outstanding scientific and technological research and at the end of the supply chain, in terms of productive systems and markets in which output and insights might have potential applications”.

During the past decade, the TDs have gained more and more importance as elements of economic development and innovation strategies of the European Union (EU) and Member States (Lerro, 2014). However, after years of TDs’ promotion and support, the performance, the effects and the impacts of the TDs still require a specific attention. In fact, both policymakers and program owners, on the one side, and TDs’ meta-management structures and TDs’ stakeholders, on the other side, are increasingly searching shared models and tools on identifying and assessing how the desired performance levels, effects and impacts have to be achieved and what kind of policy and managerial actions have to be elaborated and implemented to lead to more effective and efficient outcomes (Bigliardi *et al.*, 2006; German Institute for Innovation and Technology, 2011; Italian Agency for the Diffusion of the Technologies for Innovation, 2012).

Unfortunately, the novelty of the form of the TDs and the high attention and pressure they have received has determined a sort of “measurement mania” of their activities but not linked to a strategic and scientific approach about the assessment and the evaluation of their performance and impact. Measurement mania is the obsessive creation of measures for everything, usually resulting in such a confusing picture. It is often driven by the mantra “what gets measured gets managed” (Neely, 2002). As a result, everything gets measured and determines the tyranny of measures and targets as obsessive compulsive disorder for decision-makers and, consequently, for TDs’ meta-management structures and TDs’ stakeholders.

Often, these dynamics create conflicts and confusion and may generate dysfunctional behaviors to reach inappropriate objectives and targets: it is common in the case of asking

measures and other information that have no relevance to those who need to provide or use them.

Other elements contribute to these concerns. As [Bonaccorsi and Nesci \(2006\)](#) emphasize, engineering and orchestrating the creation and the development of TDs is not an easy task to undertake. First of all, there is the open issue of characterizing properly a firm as technology-driven ([Grinstein and Goldman, 2006](#)).

Moreover, it also requires an understanding about the identification, the role and the networks of the stakeholders, the governance structure and the managerial approaches aimed to identify and assess performance dimensions of the TDs as well as the impact of the presence and the activities of the TDs on the economic, social and environmental value dimensions of the local and national development ([Spencer et al., 2010](#)).

Finally, the number, the variety and the specific role defined by the legal form and the governance structure of the TD as well as the stakeholders' involvement and commitment into the TDs issues may determine different visions of the TD's development, different specific objectives and priorities and different economic and managerial points of view of their activities related to the TD ([Bonaccorsi and Nesci, 2006](#)).

All this requires, then, that the definition and the implementation of TDs' performance systems and related indicators have to be able to take into account the previous elements. Accordingly, TDs' managers and policymakers increasingly need frameworks and tools for defining properly performance indicators assessing TDs' effectiveness and impact on the territorial development paths. Having a strategic approach to the performance measurement and management may help to avoid this kind of problem and drive in a better way the TDs to maximize the effects and the impacts of their actions and resources.

3. Literature review on TDs' performance and impact systems and indicators: state-of-the-arts and gaps identification

The issue about how an organization identifies a set of measures that reflects the performance it is trying to achieve is a common theme in the economic and managerial literature. Numerous frameworks have been proposed according to which organizations should design and implement performance measurement systems ([Franco-Santos et al., 2007](#); [Kaplan and Norton, 1996, 2000](#); [Neely, 2002](#); [Neely et al., 2001, 2002](#) and many others). The objective of such frameworks is to help organizations to define a set of measures that reflects their objectives and assess their performance appropriately (see [Neely, 2002](#), for a review).

However, it is possible to state that the same attention and the same effectiveness in elaborating and applying strategic performance management and measurement systems has not been paid about organizational systems more complex to model and assess, such as clusters, innovative networks, TDs and *similia*. This is probably linked to the nature and the specific features characterizing these complex organizations – i.e. the role of the stakeholders involved (corporations, SMEs, universities and research centers, public institutions, governments and policy agents, banks and investors, local communities), the role of the governance model, the political constraints, the issues about the intellectual property rights (IPRs) and the ways to access funding – that let more difficult in the applicability of managerial models, techniques and tools created and traditionally and successfully applied on profit companies.

To fill these gaps, at scientific level, a systematic literature review was performed to draw relevant methodological schemes and contents about the models, the frameworks, the tools and the indicators aimed to support the identification of the value dimensions of a TD as well as to operatively assess performance and impacts of the TDs.

More in detail, the systematic literature review process was run according to [Tranfield et al.'s \(2003\)](#) guidelines. First, we used two different electronic databases to search for key

references on the area of TDs' performance. These electronic databases were ABI-Proquest and EBSCO. We searched those databases using the keywords "technology district performance". Second, we selected the relevant studies coming from these databases. Relevant studies were those that fulfilled the following selection criteria:

- research looking at TDs' performance;
- research published in peer-reviewed scholarly journals;
- private and public sector research; and
- post-2000 research.

Subsequently, we read those articles. While reading those articles, notes were taken about potential cross-references that could be relevant for our research. Through this process, further documents, including not only journal articles but also books, books chapters, conference papers and working papers, were identified and included. To assess how widely known and relevant the insights found in the literature were, we conducted a citation analysis of the papers containing each important issue. We used three different databases to carry out this analysis: the social science citation index, Scopus and Google scholar. Three databases were chosen to enhance the rigor of our citation analysis.

As a result, we found that, except some relevant and interesting research contributions focalized often on specific characteristics and aspects of the TDs performance (Bigliardi *et al.*, 2006; Chen *et al.*, 2006; Siegel *et al.*, 2003), the insights were very scarce for our research aims.

At the same time, a desk analysis about policy-based studies and reports about the assessment of the TDs as well as about the lists of indicators used in practice in internationally recognized TDs able to act as a benchmark was run. It emerged that in the past years, in particular in the EU and in the Italian context, there have been different attempts to elaborate and propose models and scorecards to identify assess and report TDs' performance (EU Innovation Scoreboard, the EU Regional Innovation Scoreboard, the European Report on Science & Technology Indicators, European Secretariat for Cluster Analysis).

For example, the [German Institute for Innovation and Technology \(2011\)](#) as part of the VDI/VDE Innovation +Technik GmbH, in the context of the project "Expertise on developing a common evaluation/benchmarking system for all Hamburg clusters" has elaborated a "cluster and network evaluation model, indicators groups and traits of methodologies for the evaluation of clusters and networks". It addresses specifically three different "subjects of evaluation" such as cluster policy, cluster management and cluster actors, and is based on the consolidated assumption that there is a link between input, produced activities directly linked to the measure (output) and intended results that occur within the target group (outcome).

Also, the [Italian Agency for the Diffusion of the Technologies for Innovation \(2012\)](#) in its report "Indicatori di risultato intermedi per misurare la performance di Distretti Tecnologici e Poli di Innovazione – valutazione di impatto: metodi ed esperienze" provides an analysis of the methodological stages to develop a system of indicators to assess TDs' performance as well as a synthetic picture of an economic and managerial model grounding the set of the indicators. Moreover, various regional institutions in Italy – within their industrial policy planning – have tried to elaborate, develop and apply grids and scorecards aimed to assess TDs' performance; particular attention has been paid on the TDs based at administrative level in their territorial borders.

Although these appreciable attempts, the insights of the double-streamed literature review clearly showed that the research issues still presented different weaknesses and challenges to be addressed. In particular, it emerged that academic research has paid little attention on the topics; at the same time, at operative level, many institutions have built

grids, or even scorecards, but not strategic performance measurement systems able to effectively model the TDs nature, properties and specific objectives to be reached and assessed through the performance system.

Moreover, it was possible to trace a sort of confusion on contents and methods as well as a recurring overlapping of economic, financial and managerial performance and impact indicators characterizing a TD. Another limitation occurs when institutions have built key performance indicators (KPI) scorecards. In fact, they revealed several missing components: no stakeholder requirements-oriented measures, common use of single process metrics often focused on initiatives and not on outcomes and impacts, no defined role for organizational competences and intellectual assets, a strange omission of the identification and the measurement of relevant meta-organizational processes.

In short, KPI scorecards seemed more as a confused collection of measures, a checklist or perhaps elements in a “scheme” useful for political affairs rather than tools to collect relevant data to support decision-making activities. In other words, they did not describe strategic plan and often did not reflect the working mechanisms of the TDs, and therefore, in different cases, KPI can be a dangerous illusion to assess TDs’ performance. Further, the different policy and normative constraints according to which TDs normally work – for example, ways to access to funding, constituency, weight of the public actors in the governance models and problems related to the IPRs – were not considered properly according to the effects they generate in practice.

All these gaps determined the main challenge to elaborate and provide a general model able to incorporate dimensions of strategic planning and performance measurement and management but declined coherently in accordance to the particular characteristics of the TDs. In particular, the idea was based on the aims to define a model that may be objective, rigorous and able to become standard according to scientific, operative and methodological perspectives.

Accordingly, the elaboration of a new model for the strategic performance measurement and management of the TD has been driven by the following methodological and contents considerations. About the former:

- *Applicability and validity for the evaluation of any TD:* The modeling has to be applicable to any TD and has to integrate potential heterogeneity regarding criteria such as industry sector, size, age, governance structure and places. The aim is to find a balance between the need of any single TD to have specific and context-related value/performance dimensions and indicators and common overall value/performance and indicators applicable to any TD.
- *Clarity of the contents:* The model has to pay great attention to avoid confusion on contents and methods as well as overlapping of economic, financial and managerial performance and impact dimensions that often have characterized the academic and policy literature about the performance and impact measurement systems of the TDs.
- *Model design:* The model has to be able to collect, elaborate and report both quantitative and qualitative data and information; in case, relevant information cannot be integrated in the general model, to avoid confusion and overlapping of different issues, these information had to be provided in separate but related frameworks and schemes.
- *Decision-making orientation:* The model has to be a decision-making tool supporting managerial, policy and political choices. It should be also a self-evaluating and learning tool able to drive performance improvement paths.
- *Integration, modularity and scalability:* The model has to lever the strengths and the relevant contents of the previous existing models, scorecards and grids already provided by the literature and practice, but it has to integrate them in a more effective,

rigorous and TD-oriented meta-model. It has to be thought according to modules letting a scalability of the level, intensity and extension of the analysis.

- *Usability and efforts*: The model has to avoid not useful and redundant questioning and has to consider always the decision-making orientation. The effort both for the actors involved in collecting data and receivers of the data have to be reduced to a minimum. The search of a right balance between the interest in revealing the “full picture” of the phenomena and the related efforts on times, costs and resources has to be strongly considered.
- *Commitment and involvement of the stakeholders*: The model has to forecast open and transparent processes to achieve desired validity of results and acceptance of the stakeholders involved. Thus, stakeholders groups should be included in the process of elaboration and sharing of the model.

While, at contents level, the elaboration of a new model for the strategic performance measurement and management of the TD has been driven on the base of a review and analysis of the “best” models and frameworks elaborated and commonly used in scientific literature and managerial practices – such as *Strategy Map* and *Success Map* (Kaplan and Norton, 2000), *Balanced Scorecards* (Kaplan and Norton, 1996), *Performance Prism* (Neely et al., 2001, 2002), *Canvas* (Osterwalder and Pigneur, 2010).

4. Findings

4.1 Methods

According to the previous methodological and contents considerations, and to achieve a more fine-grained insight into the issues, a research protocol was designed and a methodology for identifying relevant TDs areas of performance and related indicators was developed.

In particular, according to the protocol, a *first stage* of the research was about how to exploit and capitalize the efforts and the main insights of the previous systematic literature review.

Then, during the *second stage*, the areas and the indicators identified in the first stage of the research were discussed, evaluated and selected adopting a *Delphi analysis* which involved a panel of 16 policymakers, managers and experts in the field of TDs, TDs assessment and local development. It took place between March and July 2014.

The Delphi analysis has proven a popular tool for identifying and prioritizing issues for managerial decision-making (Brancheau et al., 1996; Holsapple and Joshi, 2002; Linstone and Turoff, 1975; Schmidt, 1997; Schmidt et al., 2001).

We adopted a systematic approach to conducting a Delphi analysis (Delbecq et al., 1975; Ono and Wedemeyer, 1994), as we judged it to be a stronger methodology for a rigorous query of experts and stakeholders. In particular, according to Okoli and Pawlowski (2004), we selected the Delphi analysis for the following reasons:

- the complex issue under investigation required knowledge from people who understand deeply the topic and its peculiarities. Thus, a Delphi analysis answers the study questions more appropriately;
- a panel study most appropriately answers the research question, rather than any individual expert's responses. Delphi is an appropriate group method. Among other high-performing group decision analysis methods, Delphi is desirable, in that it does not require the experts to meet physically, which could be impractical for international experts;
- although there may be a relatively limited number of experts with knowledge about the research questions, the Delphi panel size requirements are modest, and it would be practical to solicit up to four panels from 10 to 18 member in size;

- the Delphi is flexible in its design and amenable to follow-up interviews. This permits the collection of richer data, leading to a deeper understanding of the fundamental research questions; and
- according to Schmidt (1997), Delphi serves the dual purpose of soliciting opinions from experts and having them rank according to their importance.

Operatively, the Delphi questionnaires were administered using e-mail. Administration followed the procedure for “ranking-type” Delphi studies outlined by Schmidt (1997). This involved three main steps as follows:

1. brainstorming for important items;
2. narrowing down the original list to the most important ones; and
3. ranking the list of important items.

The initial questionnaire was very simple, as it consisted of an open-ended solicitation of ideas. The questionnaire asked three basic questions, each corresponding to one of the sub-specific research aims. To address the first research question, the questionnaire asked experts to list at least four important macro-areas of performance and strategic objectives affecting the TDs. To address the second research question, the questionnaire asked experts to list at least ten important performance indicators that could feasibly implement with beneficial effect on the TDs' performance assessment. Unlike the first two questions, simply asking the experts their recommendations as items, then ranking them will not appropriately address the third research question. Recommendations are complex items that result as a composite and synergistic conclusion from the findings of the other questions. Thus, to answer this question, at this stage, a third Delphi question that is closely related to the other two was used: experts were asked to offer a brief explanation of the importance of each macro-areas, strategic objective and indicators they listed for the first two questions. These explanations served the dual purpose of providing a qualitative empirical basis for answering the third research question and helping researchers to understand and reconcile the various experts' points of view. Moreover, the explanations helped to classify better their indications into categories and provided clarification for the next questionnaire, which renamed and consolidated their answers. We sent this questionnaire to all the experts and analyzed the results from all experts together. In analyzing the responses, we first removed identical responses. Then, we recorded on the consolidated lists the number of panelists that initially suggested each item, and then grouped these items conceptually into categories to make it easier for panelists to comprehend each list when returned for the next step. The grouping was simply for presentation purposes and not for analysis.

We identified over ten macro-areas of performance, over 50 strategic objectives and about 200 potential performance indicators. We made every effort to identify and select TDs' performance areas, objectives and indicators that were simple, not ambiguous and not “double-barreled”.

When researchers and experts performed the consolidation of the lists and grouping into categories, we sent a second questionnaire to validate the consolidated lists of items. This questionnaire listed all the consolidated items obtained from the first questionnaire, grouped into categories. In addition to a brief, one-sentence explanation of each indicator, an explanatory glossary was included to define and explain each indicator, based on information provided by the experts in the first questionnaire. The second questionnaire asked to experts to verify that we correctly interpreted their responses and placed them in an appropriate category and verify and refine the categorizations of the indicators. At this time, experts were able to suggest additional items that they might not have considered initially. Based on their responses, the two lists and categorizations were further refined.

Then, we presented the complete consolidated lists of items to each expert. The third questionnaire was arranged to cancel out bias in the order of listing of the items. Each

expert was asked to select at least ten indicators that they considered important to TDs' assessment. When all the panelists returned their responses, we analyzed them to identify the items selected by over 50 per cent of the experts, and we retained these items for that panel. This process reduced the lists to a manageable size, and the target size for ranking was no more than 100 items. The final phase was to reach a consensus in the ranking of the relevant items: each expert individually submitted a rank ordering of the items and provided comments explaining or justifying their rankings. At the end of this ranking phase, we had a prioritization of the items. This rigorous process assured that the items in the list were the most important. Based on these results, we were able to reassess our theoretical observations from the literature and offer coherent items aimed to assess TDs' performance and impact. A final list of TDs' performance areas and indicators was then developed, integrated and incorporated into the DETechTOR model.

4.2 The proposed model

As a result, a new model called "DETechTOR" was elaborated and adopted as new conceptual and operative model potentially driving the definition of the strategic objectives of the assessment as well as of the specific areas and indicators of performance. It plays as a model of synthesis of the previous models and frameworks, trying to decline in a coherent way their related main dimensions and macro-areas of performance, as well as specific measures and indicators for a TD.

Specifically, five macro-areas of performance were identified as relevant and having capacity of synthesizing all the insights derived by the review and analysis of the "best" models and frameworks recently elaborated and commonly used in scientific literature and managerial practices – such as *Strategy Map* and *Success Map* (Kaplan and Norton, 2000), *Balanced Scorecards* (Kaplan and Norton, 1996), *Performance Prism* (Neely et al., 2001, 2002) and *Canvas* (Osterwalder and Pigneur, 2010) as well as of being easily and coherently declined for a TD. They are presented as in the following:

- impact;
- stakeholders' value;
- processes;
- competences; and
- knowledge/intellectual capital.

However, to make it operative, i.e. to be used as a real performance measurement and management tool, the different macro-areas of performance need to be populated with a set of specific indicators to build an effective informative base to design, communicate, implement and review policies and actions aimed to check, develop and manage TDs activities. This determines that the DETechOR model, to be practically applied as assessment tool for the TDs, has to be integrated with a dedicated measurement system, i.e. a systemic body of metrics to perform a qualitative and a quantitative evaluation.

Accordingly, some related scorecards can be effectively used. Tables I-V present the various performance areas and potential indicators that can be usefully applied – according and within the DETechTOR – to the TD to better identify their effectiveness and impact on the territorial development dynamics.

5. Discussion and implications

This research has examined the issues of the performance measurement systems applied to the TDs. Specifically, the main purpose of looking them was to review and propose a general model to identify and assess performance and impacts of the TDs. After conducting a systematic literature review and a Delphi analysis, we found little and confused conceptualization of the TDs' performance measurement systems as well as related indicators. This finding has critical implications both for the literature and for

Table I The macro-area “impact”

<i>Strategic objective</i>	<i>Index</i>	<i>Impact</i>	<i>Measure</i>	<i>Target</i>
Maximizing the positive impact at industrial, socio-economic and employment level, both on the territorial system and on the sectors referred to the TD		Variation of the gross domestic product per inhabitant, in purchasing power standards in the territorial system interested by the TD R&D investments of TD's companies and public sector in TD activities/regional gross domestic product Employment rate for the age group 15-64 years in the territorial system interested by the TD Unemployment rate in the territorial system interested by the TD		
Accelerating the structural processes for the growth of the national and regional economic systems		Number of stable national links of the regional system generated by the activities of the TD Number of stable international links of the regional system generated by the activities of the TD Amount of funds provided by the EU for investments in infrastructures		
Supporting the strategic programs about research, technological development and innovation aligned and coherent with the strategic agendas at EU (i.e. Horizon 2020) and global level		Number of universities' courses based in the local system interested by the TD Number of research centers based in the local systems interested by the TD Number of agreements of the TD with secondary schools operating in the TD' area or region Number of schooling stages activated within the TD's companies Number of university stages activated within the TD's companies		

practice. It suggests that the majority of researchers in this field do not explicitly define and implement what they are referring to when they use the phase TDs' performance measurement system. This means that it is difficult for readers to know exactly what these researchers are investigating and, hence, compare different studies, generalize and draw conclusions about the body of research in the field.

Clear understanding and comparability of research is important because of the diversity of approaches used to look at performance measurement in TDs. This heterogeneity is reflected in the variety of items extracted from the Delphi analysis. Thus, although researchers may assume that there is a wide understanding of what involves or not a performance measurement system for a TD, this study suggests that this assumption may be flawed. As a result, it could be argued that if the TDs' performance measurement field is to develop and become more relevant to theory and practice, then researchers need to be more specific and explicit about the criteria of the systems they are studying. Otherwise, generalizability and comparability of research will be difficult to judge, and this has strong implications regarding the development of this field of research and its impact on practice.

Although the existence of measures for TDs' assessment is taken as a given, there is no such agreement on the nature and design of those measures. There has long been a discussion about the need to include other dimensions of performance than just financial; however, there is no consensus of what the other dimensions should be, and in fact, the evidence that there should be balance in the measures used is far from conclusive.

A further element that could be relevant is the issue of the strategic objectives. A common purpose for implementing a performance measurement system for the TDs is to achieve some organizational goals and impact on the territories, and very often, this relates to the strategic objectives. However, there are measurement systems that have only operational objectives, which may or may not implicitly or explicitly link to strategy or constituency of a TD.

Table II The macro-area “stakeholder value”

<i>Strategic objective</i>	<i>Stakeholder value Index</i>	<i>Measure</i>	<i>Target</i>		
<i>Big companies:</i> Exploiting technological assets and IPRs within projects of development and collaboration with SMEs and research centers; optimizing patents' portfolio, capitalizing non-core patents; reinforcing their supply chains with excellent SMEs	Number of projects in collaboration with research centers participating in the TD				
	Number of projects in collaboration with SMEs participating in the TD				
	Number of projects in collaboration with universities participating in the TD				
	Number of new products developed in the TD introduced in the market				
	Ratio between core and non-core patents developed by the activities carried in the TD				
	Revenue due to the sale of non-core patents				
	<i>SMEs:</i> Addressing markets for their technological assets; achieving critical level of funds to finance R&D activities; overcoming their limited capacity of market and technological intelligence; improving their attitude to buy technologies and patents	Number of projects in collaboration with big companies participating in the TD			
		Number of projects in collaboration with research centers participating in the TD			
		Number of patents purchased for the development of new products			
		Amount of money received from European funds to finance R&D activities			
Number of new products introduced in the market					
Months elapsing between the start of a project and the filing of a patent					
<i>Research centers/Universities:</i> Delivering quickly their inventions and innovation to the market; improving their capacity of technological transfer; overcoming the lack of processes and systems of asset management; reinforcing applied research; accessing to financial resources		Number of publications in scientific journals related to the field of TD activities			
		Number of research projects supported by enterprises of the TD			
		Number of research projects carried out in collaboration with TDs' firms			
		Amount of money received from European funds to finance the research projects			
	<i>Banks/investors:</i> Allocating funds on companies and technologies more promising; sustaining development and performance of their customers; innovating their portfolio of financial services	Average pay back time of investment in the TD			
		Number of new services introduced at the request of the actors of the TD			
		Number associated with the TD that use the services of banks that invest in the TD			
		Number of insolvent companies			
		<i>Public institutions:</i> Protecting and extending employment; allocating public resources to more promising sectors; developing territorial system	Number of new human resources employed by the stakeholders of the TD		
			Gender pay gap variation		
Number of stable national links of the regional system generated by the activities of the TD					
Number of stable international links of the regional system generated by the activities of the TD					
Report between the financial resources of the TD invested by venture capitalists and investments funds and the financial resources invested by the public sector					
Number of infrastructure introduced on request of the TDs' stakeholders					
<i>Meta-management structure of the TD:</i> Supporting economic and not economic performance of the members of the TD; accessing to financial resources to manage operatively the TD	Amount of European funding provided to TDs' stakeholders thanks to the intervention of <i>meta-management structure</i>				
	Ratio between public and private capital				
	Amount of money received for the management of TD				

Despite all these concerns, it is possible to state that the insights of this paper contribute at theoretical and practical level to improve the managerial and policy methods and tools to identify, assess, manage and report the performance and the impact of the TDs. Till now, in fact, it is possible to trace a lot of “cold fusions” about frameworks, aspects, dimensions and metrics, often very different among them and difficult to integrate and to become a

Table III The macro-area “processes”

<i>Strategic objective</i>	<i>Index</i>	<i>Processes</i>	<i>Measure</i>	<i>Target</i>
Quality of the industrial research	Number of specific research projects on TD issues developed at universities based in the local system interested by the TD Ratio between R&D investments of the TD's companies in TD activities and R&D total investments of the TD's companies (only private sectors) Ratio between R&D investments of the public sector in TD activities and R&D total investments of the public sector in the TD's scientific and industrial field (only public sectors) Number of projects that have led to new products on the market Number of awards			
Quality of the technological transfer	Ratio between the number of EU projects won by the TD's companies and the number of EU projects won by companies and organizations in the regional system Ratio between the number of EU projects won by the TD's companies and total number of EU projects assigned about the specific scientific field in which TD operates Number of new technologies introduced by a player and adopted by other actors in the TD Number of network activated between actors in the TD Number of companies and organizations adopting the outputs of the research developed in the TD			
Accelerating the innovative dynamics in the TD's sector and the transferring of the outputs to the market	Mean time between project funding and introduction of the outcome on the market Mean time between obtaining a patent and its introduction on the market with products Number of the start-up companies and spinoff within the TD, or operating in the TD's area Number of new private investors expressing interest in the activities of the TD Number of research centers in public-private co-financing Total amount of financial resources of the TD invested by venture capitalists and investments funds to finance start-up and scouting activities			
Promoting and sustaining the creation of new companies Optimization of the public financial resources and capacity of attraction of financial capitals and private investors	Total amount of financial resources for new initiatives found with crowd funding Number of contracts entered into with members of TD for the provision of services Number of contracts entered into with players who are not part of TD for the provision of services Time between the ideation of a new service and its introduction on the market Number of services ideated in the TD and copied from other TDs Number of actors involved in TD's projects Time needed to find an agreement among stakeholders Number of meetings necessary to define a new project European funds procured to the TD for the development of new projects Elapsed time from conception to conclusion of a new project Ratio between the number of EU projects won by the TD's companies to be attributed to the activities developed in the TD and the number of proposals on EU projects/calls delivered by the TD's companies to be attributed to the activities developed in the TD Ratio between average time to realize a project developed in TD and average time to realize similar project developed in other TDs Number of stable supply links between firms of region Number of stable supply links between firms of TD and suppliers external to the TD			
Elaborating and providing innovative, value-added and high-quality services, both for TD's members or not; effectiveness and timing of the new services development and management				
Enhancing the relationships among research, companies, banks and investors and territorial system; extension, effectiveness and timing of the networking processes management				
Promoting connections of all the players and actors operating in the supply chains of the specific sector of the TD;				

(continued)

Table III

<i>Strategic objective</i>	<i>Index</i>	<i>Processes</i>	<i>Measure</i>	<i>Target</i>
Effectiveness of the TD's governance model	Number of agreements between the stakeholders of the TD Level of satisfaction of the TD's players Number of new investors interested in the TD Number of European projects won by the district			
Extension, effectiveness and timing of the internationalization processes management	Number of coordinated and stable links activated by the TD with other international TDs Number of visiting researchers from foreign universities Number of visiting researchers from foreign research centers Number of nationalities of the companies participating in the district Ratio between the number of highly skilled foreign workers and the number of highly skilled workers trained in the territory of the TD Number of PhDs conducted in cooperation with the industries of the district Level of cooperation between firms and public actors Number of new training courses activated by TD in region Number of scholarships funded by the industries of the TD			
Effectiveness and benefits provided by TD's operative support to the national and regional politics and policies about industrial and research issues	Ratio between the number of proposals on EU projects/calls delivered by the TD's companies to be attributed to the activities developed in the TD and the total number of proposals by the TD's companies			
Extension, effectiveness and timing of the research activities developed by the TD	Ratio between the number of EU projects won by the TD's companies to be attributed to the activities developed in the TD and the number of proposals on EU projects/calls delivered by the TD's companies to be attributed to the activities developed in the TD Ratio between average time to realize a project developed in the TD and average time to realize similar project developed in other TDs			

Table IV The macro-area “competences”

<i>Strategic objective</i>	<i>Competences Index</i>	<i>Measure</i>	<i>Target</i>
Capacity of managing the specific network of the TD at operative, technical, scientific and policy level	Number of meetings with representatives of the lobby of reference of the TD		
Capacity of collaborating with other relevant national and international TDs	Number of meetings between the stakeholders of the TD		
	Number of coordinated and stable links activated by the TD with other national TDs		
	Number of coordinated and stable links activated by the TD with other international TDs		
	Number of researchers in temporary visit (maximum one year)		
Capacity of managing applied and industrial research at project, prototyping and operative level	Number of prototypes needed to obtain the commercial configuration		
	Number of actors involved in the projects		
	Number of actors sharing the results of research		
High competences on project management and technological marketing	Number of employees with a recognized qualification of project manager		
	Number enterprises to which have been sold the rights for the use of technologies developed in the TD		
High competences at technical and organizational level of the meta-management structure of the TD	Number of professional managers leading firms of the region		
	Number of large contracts awarded to the TD		

general modeling. The originality and the value of the paper resides, then, in its attempt to improve and to let more shared and transparent the informative quality on which the TDs are called to operate and report to the stakeholders, in particular regulators and public organizations.

Moreover, this paper will hopefully stimulate a debate and encourage a greater level of clarity, generalizability and comparability in the TDs performance measurement systems research arena. The definition of this general model has also the objective to support the elaboration of a structured set of managerial and policy implications able to drive, respectively, the management in the strategy formulation and implementation, as well as in the actions for the performance improvement, and the decision-makers in the elaboration of effective policies of development and correct evaluation of the impact of the TDs on the different places.

6. Limitations and future research

It is possible that this research pays a sort of disadvantage to be one of the “academic first movers” about multifaceted issues on which a complex and strong debate at academic, political and policy level is still working. So, we recognize some limitations of this study to drive further research on the issues. At academic level, the aspects related to the definitions of a TD as well as the main features characterizing TDs and the links with other configurations of local productive systems and knowledge-based networks have to be improved, as TDs may have a lot of operative declinations.

Also, the identification and the analysis of the specific mechanisms through which TDs influence growth and value creation paths at territorial and industry-level should be improved, in particular taking into account the exogenous and the endogenous factors potentially having impact on these dynamics.

Moreover, although the relevance of TD for territorial and industry value creation dynamics is recognized, some recent studies point out some problems that need to be further investigated. In particular, it is stressed the importance to better understand the uneven distribution of specific resources across TDs as well as the links and the potential mediating factors existing among TDs’ performance and value creation dynamics in terms of performance and impacts.

Table V The macro-area “knowledge/intellectual capital”

<i>Strategic objective</i>	<i>Knowledge/intellectual capital Index</i>	<i>Measure</i>	<i>Target</i>
High-skilled human resources among the TD's stakeholders/capacity to attract talents	Researchers as a percentage of persons employed in TD Number of employees in the TD with a PhD Number of scholarships awarded to researchers coming from areas that are not part of the TD number of investigations in which the firms are involved		
Quality of the training activities provided by the TD	Ratio between the total number of participants in the training activities and the total number of employees of TD Number of awards awarded to teachers in training activities Number of publications produced by the teachers of the training activities Number of students from areas that are not part of the TD		
Endowment and use of knowledge management tools (databases, social networks, etc.)	Number of databases to which the actors of the TD have access Number of intranet in the TD Number of companies in the supply chain share information		
Specific know-how of the TD	Acknowledgments awarded to employees who work it TD Number of consultancy required to firms of the TD by players that are not part of the TD Number of patents developed on the core activities of the district		
Endowment and use of R&D tangible and intangible infrastructures	Number of specific research projects on TD issues developed at research centers based in the local system interested by the TD Number of projects ideated in the district for which the development requires laboratories not available in TD Number of laboratories, which are part of the TD, that were required for the activities of other districts		
Access to relevant industry-oriented and research-oriented dataset	Number of databases which can be accessed by universities of TD Number of databases which can be accessed by research centers of Td Number of databases which can be accessed by companies of TD Number of market research to which the industries of the TD have access		
Creation, development and exploitation of a TD's “brand”	Level of recognizability of the TD Added value recognized by the market to companies that are part of the TD Level of diffusion of the products of companies that are part of the TD		
Reputation and business ethic; TD's culture	Ratio between females employed and the total number of employees by TD Ratio between the number employees on permanent contracts and total number of employed Number of investigations in which the firms are involved Gender pay gap variation		

Further critiques can be moved also to the sources of data as well as to the indicators adopted for the TDs' performance assessment. We adopted primary data sources as well as archives data. Unfortunately, there is a lack of data collected with the specific aim to capture information about the TDs.

On the base of a systematic analysis of the theory and practitioner literature, we have identified a first list of significant indicators which are not comprehensive, but represent a meaningful starting point; of course, further and different indicators can be defined.

Moreover, a more-in-depth analysis of the criteria for evaluating and selecting robust performance indicators is required in the next analyses. Criteria such as relevance, clear definition, easiness to understand and use, comparability, validity, reliability, sensitivity, affordability and accuracy in this stage of the research have not been considered in detail from a statistical point of view, but it has been the process and the research method that allowed us to consider important aspects of the selected indicators in term of their representativeness, validity, availability and so on. This has been made according to research methods and praxis commonly used and accepted in the scientific community (Ballou *et al.*, 1998; Holzer, 1989; USAID, 1996; Wang and Strong, 1996), in particular when statistical analyses are missing in the research.

It is recognized that it could be a limitation of this study, and at the same time, there is the awareness that future studies will be called to overcome this kind of gap. At practical level, specific analysis on the sovra-national and national scenarios could be useful to better highlight the real strategic aims beyond the TDs and to work toward the alignment of the national policies to the managerial actions of the TDs.

References

- Antonelli, C. (2000), "Collective knowledge communication and innovation: the evidence of technological districts", *Regional Studies*, Vol. 34 No. 6, pp. 535-547.
- Arundel, A. and Geuna, A. (2004), "Proximity and the use of public science by innovative European firms", *Economics of Innovation and New Technology*, Vol. 13 No. 6, pp. 559-580.
- Ballou, D., Wang, R., Pazer, H. and Tayi, G.K. (1998), "Modeling information manufacturing systems to determine information product quality", *Management Science*, Vol. 44 No. 4, pp. 462-484.
- Baptista, R. and Swann, P. (1998), "Do firms in clusters innovate more?", *Research Policy*, Vol. 27 No. 5, pp. 525-540.
- Bigliardi, B., Dormio, A.I., Nosella, A. and Petroni, G. (2006), "Assessing science parks' performances: directions from selected Italian case studies", *Technovation*, Vol. 26 No. 4, pp. 489-505.
- Bonaccorsi, A. and Nesci, F. (2006), *Bacini di competenze e processi di agglomerazione. I distretti tecnologici in Europa*, Franco Angeli, Milano, Italy.
- Bottinelli, L. and Pavione, E. (2011), *Distretti Industriali e Cluster Tecnologici: Strategie emergenti di valorizzazione della ricerca e dell'innovazione*, Giuffrè Editore, Milano, Italy.
- Brancheau, J.C., Janz, B.D. and Wetherbe, J.C. (1996), "Key issues in information systems management: 1994-1995 SIM Delphi results", *MIS Quarterly*, Vol. 20 No. 2, pp. 225-242.
- Cesaroni, F. and Piccaluga, A. (2003), *Distretti industriali e distretti tecnologici. Modelli possibili per il Mezzogiorno*, Franco Angeli, Milano, Italy.
- Chen, C.J., Liang Wu, H. and Wen Lin, B. (2006), "Evaluating the development of high-tech industries: Taiwan's science park", *Technological Forecasting & Social Change*, Vol. 73 No. 4, pp. 452-465.
- Cooke, P. and Morgan, K. (1998), *The Associational Economy: Firms, Regions, and Innovation*, Oxford University Press, Oxford.
- Delbecq, A.L., Van de Ven, A.H. and Gustafson, D.H. (1975), *Groups Techniques for Program Planning: A Guide to Nominal Group and Delphi Processes*, Scott, Foresman and Company, Glenview, IL.
- Eisingerich, A.B., Bell, S.J. and Tracey, P. (2010), "How can clusters sustain performance? The role of network strength, network openness and environmental uncertainty", *Research Policy*, Vol. 39, pp. 239-253.
- Franco-Santos, M., Kennerley, M., Micheli, P., Martinez, V., Mason, S., Marr, B., Gray, D. and Neely, A. (2007), "Towards a definition of a business performance measurement system", *International Journal of Operations and Production Management*, Vol. 27 No. 8, pp. 784-801.
- Freeman, C. (1987), *Technology Policy and Economic Performance: A Lesson from Japan*, Pinter, London.

- German Institute for Innovation and Technology (2011), "Expertise on developing a common evaluation/benchmarking system for all Hamburg clusters", Working Paper, German Institute for Innovation and Technology, Berlin.
- Grinstein, A. and Goldman, A. (2006), "Characterizing the technology firm: an exploratory study", *Research Policy*, Vol. 35 No. 1, pp. 121-143.
- Holsapple, P. and Joshi, K. (2002), "Knowledge manipulation activities: results of a Delphi study", *Information & Management*, Vol. 39 No. 6, pp. 477-490.
- Holzer, M. (1989), "Public service: present problems, future prospects", *International Journal of Public Administration*, Vol. 12 No. 4, pp. 585-593.
- Iammarino, S. and McCann, P. (2006), "The structure and evolution of industrial clusters: transactions, technology and knowledge spillovers", *Research Policy*, Vol. 35 No. 7, pp. 1018-1036.
- Italian Agency for the Diffusion of the Technologies for Innovation (2012), *Indicatori di risultato intermedi per misurare la performance di Distretti Tecnologici e Poli di Innovazione – valutazione di impatto: metodi ed esperienze*, Rubettino, Roma, Italy.
- Kaplan, R.S. and Norton, D.P. (1996), *The Balanced Scorecard: Translating Strategy into Action*, Harvard Business School Press, Cambridge, MA.
- Kaplan, R.S. and Norton, D.P. (2000), "Having trouble with your strategy? Then map it", *Harvard Business Review on Point Collection*, Product no. 5933, available at: www.hbr.org
- Lazzeroni, M. (2010), "High-tech activities, system innovativeness and geographical concentration insights into technological districts in Italy", *European Urban and Regional Studies*, Vol. 17 No. 1, pp. 45-63.
- Lerro, A. (2014), "Perspectives of smart specializations for a knowledge-based development – introduction to the special issue", *International Journal of Knowledge Based Development*, Vol. 5 No. 3, pp. 213-220.
- Lerro, A. and Schiuma, G. (2009), "Knowledge-based dynamics of regional development: the case of Basilicata region", *Journal of Knowledge Management*, Vol. 13 No. 5, pp. 287-300.
- Lerro, A. and Schiuma, G. (2011), "Editorial: knowledge-based dynamics of local development: a position paper", *International Journal of Knowledge-Based Development*, Vol. 2 No. 1.
- Leydesdorff, L. and Meyer, M. (2006), "Triple helix indicators of knowledge-based innovation systems: introduction to the special issue", *Research Policy*, Vol. 35 No. 10, pp. 1441-1449.
- Linstone, H.A. and Turoff, M. (1975), *The Delphi Method: Techniques and Applications*, Addison-Wesley Publishing, London.
- Maillat, D. (1995), "Territorial dynamic, innovative milieu and regional policy", *Entrepreneurship and Regional Development*, Vol. 7, pp. 157-165.
- Maskell, P. (2001), "Towards a knowledge-based theory of the geographical cluster", *Industrial and Corporate Change*, Vol. 10 No. 4, pp. 921-943.
- Moulaert, F. and Sekia, F. (2003), "Territorial innovation models: a critical survey", *Regional Studies*, Vol. 37 No. 3, pp. 289-302.
- Neely, A. (2002), *Business Performance Measurement – Theory and Practice*, Cambridge University Press, Cambridge.
- Neely, A., Adams, C. and Crowe, P. (2001), "The performance prism in practice", *Measuring Business Excellence*, Vol. 5 No. 2, pp. 6-12.
- Neely, A., Adams, C. and Kennerley, M. (2002), *The Performance Prism*, FT Prentice-Hall, London.
- Okoli, C. and Pawlowski, S.D. (2004), "The delphi method as a research tool: an example, design considerations and applications", *Information & Management*, Vol. 42 No. 1, pp. 15-29.
- Ono, R. and Wedemeyer, D.J. (1994), "Assessing the validity of the Delphi technique", *Futures*, Vol. 26 No. 3, pp. 289-305.
- Osterwalder, A. and Pigneur, Y. (2010), *Business Model Generation*, John Wiley & Sons, Hoboken, NJ.
- Owen-Smith, J. and Powell, W.W. (2004), "Knowledge networks as channels and conduits: the effects of spillovers in Boston biotechnology community", *Organization Science*, Vol. 15 No. 1, pp. 2-21.

- Pinch, S., Henry, N., Jenkins, M. and Tallman, S. (2003), "From 'industrial districts' to 'knowledge clusters': a model of knowledge dissemination and competition in industrial agglomerations", *Journal of Economic Geography*, Vol. 3 No. 4, pp. 373-388.
- Schiama, G. and Lerro, A. (2008), "Knowledge-based capital in building regional innovation capacity", *Journal of Knowledge Management*, Vol. 12 No. 5, pp. 121-136.
- Schmidt, R.C. (1997), "Managing Delphi surveys using non parametric statistical technique", *Decision Sciences*, Vol. 28 No. 3, pp. 763-774.
- Schmidt, R.C., Lyytinen, K., Keil, M. and Cule, P. (2001), "Identifying software project risks: an international Delphi study", *Journal of Management Information Systems*, Vol. 17 No. 4, pp. 5-36.
- Sennett, J. (2001), "Clusters, co-location and external sources of knowledge: the case of small instrumentation and control firms in the London region", *Planning Practice & Research*, Vol. 16 No. 1, pp. 21-37.
- Siegel, D.S., Westhead, P. and Wright, M. (2003), "Science parks and the performance of new technological-based firms: a review of recent UK evidence and an agenda for future research", *Small Business Economics*, Vol. 20 No. 2, pp. 177-184.
- Simmie, J. (2005), "Innovation and space: a critical review of the literature", *Regional Studies*, Vol. 39 No. 6, pp. 789-804.
- Spencer, G.M., Vinodrai, T., Gertler, M.S. and Wolfe, D.A. (2010), "Do clusters make a difference? Defining and assessing their economic performance", *Regional Studies*, Vol. 44 No. 6, pp. 697-715.
- Storper, M. (1992), "The limits to globalization: technology districts and international trade", *Economic Geography*, Vol. 68, pp. 60-93.
- Tallman, S., Jenkins, M., Henry, N. and Pinch, S. (2004), "Knowledge, clusters and competitive advantage", *Academy of Management Review*, Vol. 29, pp. 258-271.
- Tranfield, D., Denyer, D. and Smart, P. (2003), "Towards a methodology for developing evidence-informed management knowledge by means of systematic review", *British Journal of Management*, Vol. 14 No. 3, pp. 207-222.
- USAID Center for Development Information and Evaluation (1996), *Selecting Performance Indicators: Performance Monitoring and Evaluation*, USAID Center for Development Information and Evaluation Press Office, Washington, pp. 1-4.
- Van Looy, B., Debackere, K., Callaert, J., Tijssen, R. and van Leeuwen, T. (2006), "Scientific capabilities and technological performance of national innovation systems: an exploration of emerging industrial relevant research domain", *Scientometrics*, Vol. 66 No. 2, pp. 295-310.
- Wang, R.Y. and Strong, D.M. (1996), "Beyond accuracy: what data quality means to data consumers", *Journal of Management Information System*, Vol. 12 No. 4, pp. 5-34.

Corresponding author

Antonio Lerro can be contacted at: antonio.lerro@unibas.it

For instructions on how to order reprints of this article, please visit our website:

www.emeraldgroupublishing.com/licensing/reprints.htm

Or contact us for further details: permissions@emeraldinsight.com