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Innovation at regional level: The CIS4 two-tiered survey in Italy

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Abstract

Analysts and policy makers require information about innovation activities at regional level. CIS surveys currently carried out on the basis of the Oslo manual do not allow to build satisfactory regional indicators: innovation activities carried out by multi-plant, multi-region enterprises are attributed to the head office. This introduces a bias, in particular where head offices are concentrated in particular regions – Italy is a case in point. Another approach is based on the collection of data at the establishment level, departing from the "subject" approach at the core of the Oslo manual.

This paper describes a methodology which allows to build regional indicators in the Oslo framework. The methodology, which is currently being tested by ISTAT, implies a two-stage approach: collecting information at the enterprise level and, in the case of multi-regional enterprises, also at the sub-enterprise level The reconciliation between the information collected at the two levels is made on the basis of one of the few quantitative variables of the CIS questionnaire: the innovation expenditure. This reconciliation implies some rather strong assumptions about the "unity" of the enterprise and about the technological capabilities of establishments. Furthermore, the methodology allows to built only a limited number of indicators at regional level.

It is concluded that the two-tier approach is worth pursuing and that, if the test is successful, it might be considered for a further development of the Oslo methodology and for consideration in the next revision of the manual.

1. The measurement of innovation at regional level

Over the last few years the territorial dimension of innovation has come to the forefront of discussion both at the academic and the policy level.

In regional science various theoretical approaches are adopted to analyse the spatial dimension of innovation. Some of them refer to theoretical frameworks like the Marshallian industrial districts and externalities (Becattini, 1989), while others adopt the *milieu innovateur* approach (Aydalot, 1986). Recently the regional innovation systems (Howells, 1997, Cooke, 2000) has become most popular; this approach is based on evolutionary theories of economic and technological change, in particular on the national innovation systems tradition (Freeman, 1987, Nelson, 1993, Lundvall 1992). In this context a regional system of innovation is defined as a network of interacting public and private actors and institutions that generate, use and disseminate new technologies. The basic argument is that socio-economic and institutional interrelations produce a specific form of knowledge – the tacit knowledge - that encourages firms to locate their activities in one region rather than in another and despite of the progress of the information technologies; it conceptualises innovation as an embedded, not placeless, process that can explain the localization and the emergence of high-tech clusters in some regions worldwide. The concept of regional innovation systems has influenced the framework of current regional innovation policies, in particular those of the EU.

Although a growing number of studies carried out over the last few years contribute significantly to the understanding of the innovation process at a geographic scale, the definition of the spatial boundaries of regional systems of innovation is still lacking. This is due to two reasons: an inherent difficulty of modelling the innovation process *per se*, in particular its systemic aspects, and the complexity of the spatial dynamics of innovation – an issue that has only recently been the object of interest of analysts.

In the last few years, two main kinds of case studies were developed.

First, case studies of specific local experiences and best practices of regional innovation systems or local clusters of innovation. Most of the academic contributions adopt the method of shifting the unit of observation of the phenomenon from firm to a geographical unit (region, cluster, local system). The assumption at the basis of this literature is that the presence and concentration of specialised infrastructure (services, universities, research centre, etc.) in a territory is a sufficient condition for generating spatial interactions amongst actors. The main consequence is that, from a macro perspective, the behaviour of innovative firms remain a “black box”; the actual existence of spatial interactions, their intensity and quality remain unexplored. Another consequence of this approach is that local specificities do not allow an easy comparability of results across regions and nations (Cesaroni et al. 2003).

Second, a series of case studies based on innovative firms and their strategies and performance at local level. These studies focus on the networking effects at local level by looking at those elements which characterise regional systems of innovation through the analysis of firms’ behaviour. This is the case, for Italy, of the studies on the technological area of Catania (Buttà et al, 2004).

Collecting statistical data and building innovation indicators at local level implies the definition of the relevant geographical boundary. The current literature offers various options: industrial districts, local labour systems, metropolitan areas, clusters, administrative regions. While in theory it is possible to produce statistics at any geographical level, in practice the collection of innovation data is severely constrained by a host of factors (sample size, data capture, innovation features of the geographical areas, ect.). At the end of the day the area which, in the majority of the cases, is used in the breakdown of the data is the administrative region (in the European area the administrative regions correspond to two digit level of the NUTS Classification).

Despite the lack of satisfactory theoretical and methodological tools for collecting and analysing data of innovation at a sub-national level, many sub-national scale indicators were developed at the request of policy makers. Over the last few years, European Union research and innovation policies have been evaluated through cross-country and cross-region systems of indicators that fall under the heading of “benchmarking”, defined by the High Level Group of the European Commission as “a continuous, systematic process for comparing the performance of organisations, functions, economic processes, policy or sectors of business against the best practice in the world” (EC, 2003).

Overall, while for various aspects of regional development the indicators used for benchmarking may be considered acceptable, innovation indicators based on CIS data are quite poor.

This paper sets forth a methodology for building regional indicators in the Oslo manual framework. The boundaries of the region are those defined in the administrative sense. The methodology allows, among

other things, to built indicators which provide information on innovation features particularly relevant in the framework of the regional systems of innovation (cooperation, sources on information).

2. Regional innovation indicators: the Oslo Manual and the two-tiered approach.

The Oslo manual does not provide guidelines on how to build indicators at regional level. The manual deals with the regionalisation of innovation indicators in Chapter 4 with reference to the identification of the "statistical units" to be recommended for data collection in innovation surveys. According to the manual, the "enterprise" is the "most appropriate primary statistical unit"; however, it can not be excluded that "… for regional analysis, the establishment unit or similar units may be useful for collecting innovation data". At the same time the manual underscores that not all the indicators can be produced by surveying only a population of "establishments": "However, information on some variables should not be collected at the level of establishment (or similar units) as they refer directly to the enterprise".

One possibility to built indicators with a regional breakdown is to combine the enterprise level and the establishment level: the "enterprise" for calculating indicators about the overall business activities and strategies (the variable "innovation objectives", for instance, should be collected at enterprise level according to the Manual) and another statistical unit at sub-enterprise level in order to produce a regional breakdown for some variables.

The options implicitly offered by the Oslo manual for producing regional innovation are as follows:

1) Surveys of establishments
a) surveys of kind of activity units (KAUs)
b) surveys of local units*
2) Surveys of enterprises and establishments ("two-tiered surveys")
a) collections of data at establishment level to be consolidated at enterprise level. There is only a "statistical unit used for analysis", that is the "enterprise" but different "statistical units for data collection" (establishments) can be allowed.
b) collections of data at both enterprise and the establishment level. Using both "primary" (enterprises) and "secondary" (establishments) statistical units for data collection.**

* A special case of a survey on local units would be a survey on "regional branches of enterprises", i.e. statistical units including all local units of an enterprise based in a region.

** A special case would be a survey using, as secondary statistical units for data collection, "regional branches of enterprises", i.e. statistical units including all local units of an enterprise based in a region.

The Oslo manual can accommodate the "two-tiered" approach to obtain information which would be relevant both at the "strategic" (enterprise) and "local" (establishment) level. The manual also underscores potential problems; for instance, with reference to the case 2a, "…a drawback is that ….. establishments may not be in a position to respond to all questions on innovation.".

The approach 2b is apparently more sophisticated (besides being by far more expensive) in that it envisages the collection of all information available to the enterprise both at central and local level. Unfortunately, nothing is said about how to manage the "reconciliation" of data provided by different respondents for the same enterprise from a methodological and statistical point of view.

The final recommendation of the manual – "Care should be taken in aggregating establishment results to the enterprise level …" - does not seem to be very helpful in this respect.

Since its first version (OECD, 1992), the manual focuses on the enterprise not only as the most appropriate statistical unit (being, at the same time, a legal unit in most OECD countries) but also as the key organisation where innovation processes take place and even the essential "dynamo" of the innovation-driven growth.

As a consequence, several innovation indicators can only be defined as "enterprise-related" indicators, e.g.:

- types of innovation introduced by the enterprise,
- objectives of the innovation projects undertaken by the enterprise,

- co-operation activities of the enterprise in developing new innovations,
- factors hampering the enterprise ability to introduce innovations, and so on.

So far, two approaches have gained popularity among data producers:

- undertaking innovation surveys using the "enterprise" as the only statistical unit, and calculating regional breakdowns with reference only to the region where the enterprise's head office is located;
- undertaking innovation surveys using the "establishment" (i.e. the "local unit") as the statistical unit.

As to the first approach, it is clear that enterprises with establishments in more than one region are considered as performing all their innovation activities in the region of the head office: this introduces a significant regional bias. A case in point is Italy, where many firms located in the Northern regions have production facilities in the South: this approach would not allow the innovation capabilities in the South to "emerge".

As to the second option, the use of the establishment as only statistical unit for innovation surveys is not recommended by the Oslo manual which is "… concerned with the collection of innovation data at the level of firm" and suggest that " … the enterprise is in general the most appropriate statistical unit". The establishment based approach implies some "destabilising" effects on one of the pillars on which the Oslo methodology is built. In fact the enterprise is no longer considered at the centre of the innovation processes. The approach assumes that some branches of an enterprise may be innovators by themselves on the basis of their technological capabilities (R&D labs, design departments, high level technicians, etc.) without relying much on the enterprise's head office. In a way, looking at the innovative enterprise as an "organism", it is like to accept that an arm could move independently from its brain.

A third option is to carry-out a two-tiered survey, basically an innovation survey collecting data both from primary (enterprises) and secondary (establishments, local units or groups of them) statistical units.

The two-tiered approach raises various methodological issues, e.g.:

- which indicators can be produced on the basis of the information collected from each statistical unit,
- whether and how information collected from "enterprises" and "establishments" can be merged,
- how to calculate samples and how to manage the weighting process,
- how to deal with inconsistencies in information collected from a primary statistical unit and one or more secondary statistical units belonging to it.

Table 1 shows the basic features of these three approaches and their consistency with the Oslo manual recommendations.

Table 1. Comparison among different methodological approaches for producing a regional breakdown of innovation indicators; their coherence with the Oslo manual methodology and the availability of indicators

Statistical approach with reference to the statistical unit	Consistency with the theoretical background of the OM	Availability of innovation indicators at regional level
Enterprise as the only statistical unit (*regional breakdown weighted on the region where the head office is based*)	High. The enterprise is the statistical unit recommended by the Oslo manual for data collection and analysis	High by coverage: all indicators are available at both national and regional level Serious bias due to enterprises with establishments in more than one region
Establishment as the only statistical unit	Low. The Oslo manual is based on the enterprise as the statistical unit, and the establishment is taken into consideration only as a potential "secondary unit" for data collection	High by coverage: all indicators available at both national and regional level. Data not comparable with those stemming from the Oslo methodology
Two-tiered approach *(the "enterprise" as primary statistical unit and "regional branches" as secondary statistical units)*	High. The enterprise is the statistical unit recommended by the Oslo manual. The adoption of enterprise's regional branches as "secondary statistical units" for data collection is not excluded by the manual	Only some indicators available at regional level with no biases for multi-regional innovators. Results consistent with national totals

As shown in Table 1, each of the three approaches has its own advantages and disadvantages with reference to the compliance with the Oslo manual theoretical approach and to the possibility to built a set of regional indicators.

In general, the approaches using only one statistical unit for data collection (either the enterprise or the establishment) can assure a wide coverage in terms of regional innovation indicators which, however, have very limited heuristic value in terms of measuring innovation at regional level. The two-tiered approach has

the advantage to be consistent with the Oslo manual conceptual framework, to yield meaningful regional indicators, but it allows only a limited number of indicators.

Table 2 shows the indicators required by the European union Regulation 1450/2004. The Regulation refers to data at national level, not necessarily at regional level. Looking at Table 2, while the "traditional" Oslo survey based on enterprises and the one based on the survey of establishments can allow to build all indicators (with their inherent limitations), the two-tier approach is less "productive" (but delivering much better quality): it provides an answer only to indicators 1, 5, 6, and 8 out of nine indicators.

Table 2. Main Oslo Manual innovation indicators as requested by the European Regulation 1450/2004. Availability of the regional breakdown according to the innovation survey approach

Indicators	Availability of the regional breakdown by methodological approach		
	Survey of enterprises	Survey of establishments	Two-tiered survey
1 Number of innovative enterprises as absolute value and as a percentage of all enterprises	Available, with reference to the region of the enterprises' head-offices.	Available in terms of number of establishments (the concept of innovative establishment applies).	The absolute number of innovative enterprises by region will be made available. The percentage of all enterprises in a region will not be available.
2 Number of innovative enterprises that introduced new or significantly improved products, new to the market. As absolute value, as a percentage of all enterprises and as a percentage of all innovative enterprises	Available, with reference to the region of the enterprises' head-offices.	Available in terms of number of establishments (the concept of innovative establishment applies).	The indicator will not be available. The introduction into the market of new products/services can not be split by region.
3 Turnover from innovation, related to new or significantly improved products, new to the market. As absolute value, as a percentage of total turnover and as a percentage of total turnover from innovative enterprises	Available, with reference to the region of the enterprises' head-offices.	Potentially available in terms of establishment's turnover (the concept of innovative establishment applies).	The indicator will not be available. The turnover from the introduction into the market of new products/services can not be split by region.
4 Turnover from innovation, related to new or significantly improved products, new to the firm, but not new to the market. As absolute value, as a percentage of total turnover and as a percentage of total turnover from innovative enterprises	Available, with reference to the region of the enterprises' head-offices.	Potentially available in terms of establishment's turnover (the concept of innovative establishment applies).	The indicators will not be available. The turnover resulting from introduction into the market of new products/services can not be split by region.
5 Number of innovative enterprises involved in innovation cooperation. As absolute value and as a percentage of innovative enterprises	Available, with reference to the region of the enterprises' head-offices.	Available in terms of number of establishments (the concept of innovative establishment applies).	The absolute number of innovative actors involved in innovation cooperation by region will be made available. The percentage on the regional enterprises total will not be available.
6 Innovation expenditure as absolute value	Available, with reference to the region of the enterprises' head-offices.	Available in terms of innovation expenditure by establishments.	Available in terms of innovation expenditure of enterprises by region.
7 Number of innovative enterprises that indicated highly important effects/objectives of innovation. As absolute value and as a percentage of all innovative enterprises	Available, with reference to the region of the enterprises' head-offices.	Available in terms of number of establishments (the concept of innovative establishment applies).	The indicators will not be available. The impact of innovation effects/objectives can not be split by region.
8 Number of innovative enterprises that indicated highly important sources of information for innovation. As absolute value and as a percentage of all innovative enterprises	Available, with reference to the region of the enterprises' head-offices.	Available in terms of number of establishments (the concept of innovative establishment applies).	The absolute number of innovative enterprises that indicated highly important sources of information by region will be made available. The percentage on the regional enterprises total will not be available.

9 Number of enterprises facing important hampering factors. As absolute value, as a percentage of all enterprises, as a percentage of all innovative enterprises and as a percentage of non-innovative enterprises	Available, with reference to the region of the enterprises' head-offices.	Available in terms of number of establishments (the concept of innovative establishment applies).	The indicators will not be available. The impact of factors hampering innovation can not be split by region.

3. Developing a two-tiered innovation survey in Italy

In 2005 ISTAT launched a project on the regionalisation of innovation indicators in the framework of the European CIS4 survey. One of the main objectives was to exploit, as much as possible, the CIS4 infrastructure to collect data relevant to the regional level of analysis. On top of the ordinary survey of innovating firms, a statistical survey of around 2,000 Italian multi-plant innovative enterprises was planned in order to collect information about the innovation activities of their establishments located in regions different from the region of localisation of the head office.

The Italian CIS4 was based on a two-tiered approach which consists of treating separately:

- primary statistical units in the framework of the EU harmonised CIS4, and,
- secondary statistical units (that is, local units including all the activities within a region at NUTS2 level) to be surveyed through computer-assisted personal interviews (CAPI).

As a consequence, the structure of the Italian survey was designed as follows (Table 3):

- first stage: mail survey of all enterprises (with some additional questions on their innovation activities at regional level);
- second stage: CAPI survey of innovative enterprises with establishments in more than one Italian region using an additional questionnaire on the regional distribution of their innovation activities.

Table 3. Structure of the ISTAT two-tiered innovation CIS4 survey

Stages	Respondents	Data collected on regional activities
First stage *(main CIS4 mail survey - Eurostat survey)*	Single-plant innovative enterprises	All CIS4 variables + innovation information from locally based sources + innovation cooperation with locally based institutions
	Multi-plant innovative enterprises	All CIS4 variables but no specific questions on the regional breakdown of their innovation activities in the main questionnaire
Second stage *(CAPI survey)*	Multi-plant innovative enterprises	CAPI questionnaire on: local units performing innovation activities + regional breakdown of turnover, employees and innovation expenditure + public funding at regional level + locally-based institutions providing innovation information + innovation cooperation with locally based institutions

While the CIS4 survey was completed within July 2006, the second-stage survey on multi-plant enterprises will be carried out, using a CAPI approach, in September 2006. Only limited information from testing interviews is available so far.

Since regional data had to be collected in both stages of the CIS4, special attention was paid to the inclusion into the Eurostat CIS4 questionnaire of a few questions on the innovation activities undertaken at regional level by innovative enterprises in order to make available some "regional" indicators consistent with those which will be produced by the CAPI survey. In fact, final data will result from the consolidation of "regional information " collected from single-plant enterprises through the main CIS4 and of "regional information" collected on the regional activities of multi-plant enterprises in the second stage (CAPI) of the survey.

4. The expected outcome of the Italian two-tiered survey

In order to produce a set of regional indicators consistent with that available at national level, data collected through the two main stages of the innovation survey have to be consolidated according to pre-defined rules.

The variable on "innovation expenditure" is a special case in this context. Since data on expenditure are strongly localised, information collected on expenditures both at enterprise-level (for single-plant

enterprises) and at regional level (for multi-plant enterprises) can be summed up and weighted up to the total population of enterprises to estimate regional totals.

Much more complex is the data processing for the remaining set of variables. For these variables, a conceptual difficulty rests with the methodological problem of how weighting them. The problem can be defined as follow. For single-plant enterprises, which are based by definition only in one region, enterprise-level weights can be used for producing both the national and the regional totals for all variables. For multi-plant enterprises a more elaborated approach has to be developed in order to break down the enterprise-level weights according to the regional distribution of their innovation activities. For example, if an innovative enterprise is assumed to represent a number *n* of enterprises in the sampled population and it undertakes innovation activities in three different regions, a fraction of the original weight *n* should be assigned to each region in order to identify the contribution by the three regions to the overall innovation effort by the enterprise (and by similar enterprises in the sampled population).

Under the assumption that data collected through the second stage of the survey have to be weighted using enterprise-level weights, several issues have to be tackled:

- how to weight the contribution of each single region (i.e. of one or more establishments based in that region) to the innovation effort of a multi-plant enterprise,
- how to classify the establishments (or groups of establishments located in the same region) belonging to an innovative enterprises in terms of "innovation capacity"; that is, providing a definition of the "innovative establishments (or groups of establishments)",
- whether to built regional estimates based on an enterprise-level indicator (thus accepting to consider fractions of enterprises, for instance "4,658.7 innovative enterprises in Region X") or calculating alternative indicators at establishment-level ("23,546.8 innovative establishments in Region X") or as absolute value ("the innovative performance of the Region X is 6.7 out of ten").

4.1 Weighting

As for weighting, the ISTAT proposal is to split the enterprise-level weight by region according to the relevance of the innovation activities developed at regional level. As a result, the total number of enterprises will remain the same as for the indicators at national level, and a breakdown in terms of number of enterprises will be available at regional level. For instance, an indicator will be produced on the "number of innovative enterprises in Region X", as well as an indicator on the "percentage of innovative enterprises in Region X on all enterprises in the country". Since the population at country level will be kept as the reference population, an indicator such as "percentage of innovative enterprises in Region X on all enterprises in Region X (innovation intensity at regional level)" will not be available.

4.2 Classifying

The second problem rests with the classification of establishments (or groups of establishments located in the same region) in terms of "innovation capacity". In order to split the enterprise-level weight into two or more "regional weights", it is necessary to identify which establishments (as well as, groups of establishments) can be defined as "innovative" and to measure their relative contribution to the overall enterprise's innovation activity. It is quite possible that only some of the establishments of a multi-regional enterprise are innovative, while others are not. A method, which is being tested in the framework of the ISTAT project, is based on a classification of the surveyed establishments:

- head offices of "innovative enterprises" will be considered "innovative" by definition, being the place where innovation strategies and activities are designed and managed,
- establishments other than the head office (including R&D laboratories and design centres) will be considered "innovative" if they reported innovation expenditure during the last reference year of the survey.

After the identification of the establishments (or groups of establishments) which are considered "innovative" and, as a result, of the regions where the concerned enterprises carried out relevant innovation activities, the contribution from each region will be measured. A preliminary method for measurement, which will be tested by ISTAT, was defined as follows.

- a percentage[1] of the enterprise-level weight will be attributed to the region where the head office is located;
- the remaining part of the enterprise-level weight will be attributed to each region with innovative establishments, as a proportion of the share of the enterprise's innovation expenditure covered by the local units based in each region.

The use of the innovation expenditure's regional breakdown as main criteria for evaluating the distribution of the innovation burden among an enterprise's local units is considered to be reasonable and acceptable since "innovation expenditure" is the only purely quantitative variable collected through innovation surveys to measure the innovation activity carried out by enterprises. Furthermore, the use of alternative variables for weighting the contribution of each "regional" group of establishments to the overall enterprise innovation activity – for instance, the total turnover or the total employment at regional level – can not be ruled out and will be tested as well[2].

Some aspects of the two-tier approach deserve further consideration:

- whether it is appropriate to consider innovative the head office of a multi-regional firm even if it is merely an administrative location without production or commercial activities,
- whether it is appropriate to consider innovative establishments like R&D or design departments which, according to the Schumpeterian definition adopted by the Oslo manual, are not innovative as they do not commercialise new products and products,
- whether it is appropriate to consider innovative establishments those which innovate merely buying new machinery, but which have no technical capabilities. In this case these establishments, even though they may have some impact on the local environment, most likely are not part of the regional innovation system.

4.3 The indicators to be built

Various innovation indicators can be produced on the basis of the two-tier approach. However, the difficulties in matching enterprise-level and establishment-level information implies strong limitations. Thus, several indicators recommended by the Oslo manual may not be available with a regional breakdown. The ISTAT project is currently aimed at producing the following indicators:

Indicators of *innovation activity*
- "number of innovative enterprises[3] in Region X";
- "percentage of innovative enterprises in Region X on all innovative enterprises in the country";
- "percentage of innovative enterprises in Region X on all enterprises in the country";

Indicators of *innovation expenditure*
- "innovation expenditure in Region X, total and by type of expenditure";

Indicators of *innovation cooperation*
- "number of innovative enterprises involved in innovation cooperation in Region X";
- "percentage of innovative enterprises in Region X involved in innovation cooperation on all innovative enterprises involved in innovation cooperation in the country";
- "percentage of innovative enterprises in Region X involved in innovation cooperation on all innovative enterprises in the country";

[1] Any assumption about the value of such percentage not resulting from a detailed analysis of the costs supported on average by the head office of a multi-plant enterprise to manage one or more innovation projects would be arbitrary. In the framework of the ISTAT CAPI survey, company managers will be asked to provide estimates of the costs of managing multi-regional innovation projects in order to calculate this percentage.

[2] The use of qualitative variables to take into account the "type of innovation activity" carried out at regional level will be tested in the weighting process.

[3] In this context, by "innovative enterprises" we mean enterprises, or fractions of them, having undertaken innovation activities in a specific region. It can be stressed that, at country level, the sum of the "innovative enterprises" based in all regions will equal the total of "innovative enterprises" at country level.

Indicators of highly important *sources of information for innovation*

- "number of innovative enterprises in Region X that indicated highly important sources of information for innovation";
- "percentage of innovative enterprises in Region X that indicated highly important sources of information for innovation on all innovative enterprises that indicated highly important sources of information for innovation in the country";
- "percentage of innovative enterprises in Region X that indicated highly important sources of information for innovation on all innovative enterprises in the country";

In principle, the calculation of some indicators based on ratios should be excluded because of the peculiarity of the definition of the "innovative enterprises" adopted in the two-tier approach that does not allow for a denominator including "all innovative enterprises in a region" which would result from bringing together enterprises as well as fractions of them.

A possible alternative would be to produce ratio indicators calculated in terms of percentage of "total turnover" or "total employees", thus considering a lower level of detail. According to this approach a few additional indicators might be made available:

Indicators of *innovation activity*

- "percentage of turnover of innovative enterprises in Region X on total turnover in Region X";
- "percentage of employees of innovative enterprises in Region X on total number of employees in Region X";

Indicators of *innovation cooperation*

- "percentage of turnover of innovative enterprises involved in innovation cooperation in Region X on total turnover of innovative enterprises in Region X";
- "percentage of employees of innovative enterprises involved in innovation cooperation in Region X on total number of employees of innovative enterprises in Region X";

Indicators of highly important *sources of information for innovation*

- "percentage of turnover of innovative enterprises that indicated highly important sources of information for innovation in Region X on total turnover of innovative enterprises in Region X";
- "percentage of employees of innovative enterprises involved that indicated highly important sources of information for innovation in Region X on total number of employees of innovative enterprises in Region X".

5. Final remarks

The proposed two-tier approach to the regionalisation of innovation data collected with the Oslo manual methodology is expected to yield indicators of a higher quality than those built on the other two current approaches (the one based on the head office and the other on subsidiaries). Its strengths are:

- the consistency with the "subject" approach of the Oslo manual,
- the opportunity to collect information about the relationship between the different branches of a multi-localised enterprise in developing and implementing innovation projects. This information is not totally exploited in the current statistical practice but may be used as supplementary information and may even lead to the development of new indicators,
- the possibility to provide a special focus on large enterprises and their innovation strategies. Even though small and medium enterprises play a key economic role in the diffusion of innovation in several countries, large enterprises are still the main producers of knowledge. Thus, even though a number of innovation policies are targeting small and medium enterprises, a more complete statistical information on large companies' regional (and international) innovation strategies is of great relevance.

The two-tier methodology has its own limitations, namely:

- the collection of data at regional level on multi-regional enterprises is expensive,
- the number of indicators allowed by the methodology is limited,

- the outcome of the survey is constrained by the *a priori* definition of the geographical level of analysis.

The methodology could be taken into consideration in the revision of the Oslo manual. A specific chapter dealing with the measurement of the regional dimension of innovation might be introduced which recommends the use of internationally accepted guidelines, though the regional dimension has very specific national features.

Such a methodological framework should include:

- a clear definition of the territorial units relevant to the innovation phenomenon;
- guidelines on how to manage an innovation survey based on both "primary" and "secondary" statistical units;
- the identification of a number of selected regional indicators at enterprise level, along with an assessment of their informative contents.

Although we believe that this is a sensible proposal, we wonder if another major expansion of the ground of the Oslo manual (from manufacturing to services, from technological to organisational and marketing innovation) may not "stretch" too much its theoretical foundations so that its "robustness" is compromised.

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