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**Criteria and indicators to evaluate the innovation
capacity of research performing organizations.**

Introductory note

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Content

- What is innovation
- Innovation and PROs
- National experiences
- Conclusive remarks

What is innovation?

- Any kind of novelty: artistic, scientific, technological, organisational, cultural, social, industrial (Godin, 2008, Nowotny, 2006)
- Until sixties innovation was a key characteristic of the artist, the inventor, the scientist, the entrepreneur; innovation contributes to shape cultural and social values
- From sixties innovation is technological innovation, because technology is a source of economic growth (patent laws and industrial labs)
- Innovation is mainly an industrial and economic affair (Community innovation surveys, Oecd Oslo Manual)

What is innovation?

- Shift from the meaning of innovation as a concept linked to invention and imagination of individuals (scientists) contributing to the progress
- To
- The new meaning of innovation as the creativity developed by individuals, placed inside institutions, which are supposed to contribute to industrial development and economic growth
- Break with the past:
 - Innovation as useful invention
 - Innovation as product of organisations
 - Benefits coming from innovation concern economics not culture or civilisation

Concept of innovation in firms

- The Oslo Manual focuses on firms
- 1992 radical innovation *and* incremental innovation (new product or process, implementation of a product or a process)
- 1997 pure innovation *and* imitative innovation (new for firm, new for the market)
- 2005 innovation is a result of knowledge circulation and diffusion (purchase of high-tech machinery, publications, participation in conferences, research collaborations of individuals and collaboration agreements)

Innovation and PROs

- According to the dominant position, PROs capability to contribute to innovation is related to their participation to the technological development mainly through the production and commercialization of technological outputs, and through research collaboration
- A different interpretation is related to a concept of innovation as capability to develop “non-conventional research”, that is research projects devoted to explore new research paths, characterised by trans-disciplinarity, new scientific paradigms, innovative theoretical and methodological approaches. This research is risky, the uncertainty about (useful) results is high, as well as the possibility to fail.

The Italian experience

- Evaluation of Public Research Institutes CIVR 1999-2001
- Three-Years Evaluation Exercise VTR, CIVR 2001-2003
- Experiences of public research organizations (CNR, INFN)
- Guideline for the National Agency of University and Research Evaluation (ANVUR)

Evaluation of Public Research Institutes

CIVR 1999-2001

- Self evaluation and External evaluation
- Criteria for innovation:
 - Perspectives of innovation in research projects (in short-medium period) as to types of foreseen results
 - Relationships with economy and society (collaborations in big research projects with public and private organizations; supply of high tech services to public and private organizations)
 - Impact of research on economy and society (patenting and services for firms, tacit knowledge exchanges)
 - Capability to attract external resources (funding and human resources)

Evaluation of Public Research Institutes

CIVR 1999-2001

- Not a compulsory list of indicators, because of the great variety of PROs under evaluation
- Perspectives of innovation: qualitative assessment of research projects by peers
- Collaborations: count of partnerships, peers assessed the importance
- Impact: count of patent applications (national, pct, international), of spin offs, value of contract for services
- External resources: amount of contracts from external source of funding; exchange of researchers with firms and other public and private research institutions (number)
- Scarce possibility to compare innovation capability between PROs (only external sources of funding and count of patents were used)

Experiences of PROs

- Apart from indicators on patents and spin-off, INFN highlighted special high risky projects, funded on a competitive way, as indicator of the Institute commitment toward innovation in research (number of projects, researchers involved, amount of investment normalised on total R&D investment)
- INFN developed indicators specifically related to investment on large scale facilities which impacted positively on firms suppliers of devices and machinery (i.e. CERN right return coefficient)
- INFN made a survey on working positions reached by young researchers trained, in order to assess the contribute of the Institute in terms of high skilled human resources
- CNR provided good indicators on patent portfolio and patent applications (cost, revenues, net income, break for national, pct and international patents)

VTR 2001-2003

- Evaluation of excellence of disciplines within research institutions
- Involving both Universities and PROs under the Ministry of University and Research control (academic-related institutes) on a voluntary basis
- Other Institutes can ask to be evaluated (and pay for it)
- Peer review on publications and patents submitted as scientific outputs to disciplinary panels, and indicators on the performance of the Institution

VTR 2001-2003

- Innovation was included as one of the criteria suggested to peers in order to evaluate all the outputs submitted by the institutions (Guidelines for Panels, www.civr.it)
- It was defined as “originality/innovation = contribution to new acquisitions and progress of knowledge, in the reference sector”
- Patents were evaluated by using the same criteria of the other products, but they also included the assessment of the economic and employment impact, even potential
- Peers judged patents as outputs of less quality than publication (articles, books, chapters in books, proceedings)
- Crucial elements in the peers’ assessment was the internationalisation of the patent, the presence of a firm within the inventors, and the presence of a commercialisation (licensing) agreement

VTR 2001-2003

- Innovation as composite concept: capability to attract resources from the market, to exploit research results, to create collaborative pattern with economic and social actors
 - External source of funding (different from Government and EU/International funding)
 - Investment for high tech equipment, databases or software for research activities (only equipment with a value higher than 500.000 Euros)
 - Partnerships based on agreement with a high economic value (=/+ 500.000 Euros)
 - Patents: portfolio and applications (national, pct, international) in the considered period
 - Costs and Revenues form patents
 - Spin off, partnerships, confidential agreements, advisory activities, other activities of knowledge transfer: assessment of the importance in terms of investment and impact (job placement)

VTR 2001-2003

- Peer judgements and external source of funding were considered in the model for resource allocation (with a different weight: 4 and 1 respectively)
- A specific composite indicator is linked to the capability of the institution to contribute to economic development:
 - number of patents
 - number of spin off
 - number of qualified partnerships
 - patent revenues
 - total investment of the institution for economic exploitation of research results (normalised on the total national investment for economic exploitation)
 - but with a very low weight: 0,5

ANVUR

- It is still to be implemented
- Guidelines for the Agency include recommendations for the institutional evaluation
- No specific mention of indicators, but quantitative methods must be included
- Need to consider indicators related to the mission and objectives of the Institutions
- Level of internationalization and capability to support the local economic system are highlighted as most important components of the evaluation, as well as efficiency and effectiveness

Comparing different Italian experiences

- Innovation mainly conceived as capability to produce technological outputs
- Technological outputs are identified by patents and spin offs. No mention of other relevant outputs of PROs (i.e. databases, software, tools), and an incomplete representation of the contribute given by social sciences and humanities
- Some confusion between innovation capability and impact of research results (economic and social)
- Indicators on research collaborations are included only for very large agreements (no coverage of the collaboration within research projects)
- Focus on firms as organizations addressed by the innovation capability of PROs
- Tentative to include a qualitative assessment of innovation capability linked to the perspective/originality of the research projects

A possible way forward

- Innovation capability of PROs cannot be limited to production of technological outputs but should also include their capacity to develop “non conventional research”
- This would imply a great attention to interdisciplinarity, trans-disciplinarity, collaborations, co-development of knowledge, as well as training and mobility of human resources
- Indicators to be implemented should be selected on the basis of their relevance, feasibility, transparency, and comparability
- Indicators are not neutral: the underlying conceptual framework shape their significance in the context of evaluation (what is the underlying PROs model?)
- It is important to select sources, definitions and methodologies, taking into account what is yet available at international level: “we do not have to reinvent the wheel”

A possible way forward

- Indicators which can be developed by using international sources:
 - Co-publication of researchers in PROs with non-academic researchers (ISI resources)
 - Patenting of PROs (EPO database)
 - Citation of papers in patents (EPO database)
- Indicators which can be developed using national sources:
 - Contracts (number and amount) from external sources (firms, local government, non for profit, etc.), separating research contract from service contracts
 - Revenues from licensing IPR
 - Young researchers generated by collaborative research project or Phds/post-doc/research grant in collaboration with non-academic partners
 - Mobility of researchers from/to firms and other private organizations
 - Research projects co-developed with non-academic partners (amount)
 - ERC and IDEAs research grant (number and amount)
- Developing indicators using national sources implies hard work on definitions and methodologies in order to have comparable measures.

Conclusions

- Limited number of reliable and feasible indicators
- Quantitative measures should complement qualitative assessment of innovation capability
- Important to understand differences between disciplines and sub-disciplines: the traditional division between hard sciences and soft sciences does not work
- Innovation and internationalization are related issues: embedment in international collaboration is a key factor for producing innovative and non conventional research