THE EVALUATION EXPERIENCE OF THE ITALIAN INFN (NATIONAL INSTITUTE OF NUCLEAR PHYSICS): STATE OF THE ART AND OPEN PROBLEMS*

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The Italian Istituto Nazionale di Fisica Nucleare (INFN) promotes, coordinates and carries out research in sub-nuclear, nuclear and astro-particle physics, as well as the technological research which is relevant to these fields. Like all Universities and Research Institutions in Italy, INFN has been scrutinized for evaluation by the relevant Research Ministry body (CIVR, Comitato per l'Indirizzo e la Valutazione della Ricerca) with reference to the 2001-2003 triennium. We report here on the state-of-the art of the INFN 6 years experience on self-evaluation, performed to fulfill the CIVR requests and guidelines, and on the results of the first triennial CIVR evaluation exercise while ranking the main Italian funding Agencies for research in the Area of Physical Sciences.

1. Introduction

The mission of the National Institute of Nuclear Physics (INFN) is to perform experimental and theoretical scientific research in sub-nuclear, nuclear and astro-particle physics, as well as the relevant technological R&D activities. The research work is currently organized along 5 main research lines, and is carried out in strict partnership with the Universities, within the framework of the international context and competition.

The (head count) manpower involved is of about 1800 researchers (currently 50% INFN staff and 50% INFN associates - mainly University staff). On the national territory (see Fig. 1), INFN has 20 seats (Sezioni) located at University Departments and 4 National Labs (NL), hosting important research facilities open to home and foreign scientists. Smaller units (Gruppi collegati) operate at Universities where no INFN Sezione is present.

Fig. 1.-The INFN seats

2. The INFN self-evaluation procedures

Since the early 70's, on the basis of peer refereeing, INFN set up an internal procedure for the selection, review and evaluation of the (bottom-up) proposed scientific programs. Five National Scientific Committees (NSCs, one per each scientific research line) follow all features (scientific, financial, organization, manpower) of the INFN-supported research, from the initial proposal up to its conclusion. The NSCs formulate recommendations to the Board of Directors on the scientific programs of each research line, actually carrying out both the ex-ante and the ex-post yearly peer reviews of the Institute programs.

Furthermore, in order to reinforce the evaluation of its own activities, in 1996 already INFN appointed an International Evaluation Committee (CVI), later merged in the (Ministry-demanded) Internal Evaluation Committee, which kept its international composition. Starting from the (1999) Research Ministry establishment of the CIVR (Address Committee for the Evaluation of Research), the CVI activity focussed on reporting on the INFN activities in order to answer the CIVR requests.

The CVI reports were expected to be founded on the Institute self-evaluation. This was carried out by 5 Working Groups on the Research Evaluation (GLVs, one per research line). Each GLV, made of 3 Members, worked in close connection with the corresponding NSC to discuss and elaborate the material to be submitted to the CVI, witch issued annual reports on the INFN scientific activity. This was examined in terms of the CIVR criteria and indicators for the evaluation, which were discussed and accepted in a joint CIVR-INFN workshop, held at the Frascati NL in July 2000.

The CIVR criteria concern (a) the Scientific Contents, (b) the Socio-economic and Interdisciplinary (SE&I) Impact, and (c) the Resource Management of the INFN research.

3. The two-steps evaluation procedure for the first triennial (2001-2003) research evaluation exercise (VTR)

The so-far fully accomplished evaluation of the INFN research concerns the triennial period 2001-2003, and was carried out via a two-steps procedure: first came the self-evaluation one, involving a high degree of engagement of the Institute and of its GLVs, and issuing the CVI reports; the Government step followed, yielding the INFN rating and inclusion in the ranking list of the funding Agencies in the Area of Physical Sciences.

In order to achieve the first step, the GLVs issued in 2004, and submitted to the CVI (i) two unified reports, on the Scientific Contents and on the SE&I impact of INFN research, respectively, with reference to the three-years period 2001-2003; (ii) the description cards of 660 selected research products (SRP: mostly publications on international scientific journals) to be examined by the CIVR-appointed Area Research Panel. The number of SRP was conventionally established as 50% of the average full time equivalent (FTE) research manpower during 2001-2003.

For the second step, the Area Research Panel, in its turn, examined each SRP on the basis of international (and anonymous) peer refereeing. Each SRP was thereby rated on the scale of value shared by the international scientific community as being Excellent (E, top 20%), Good (G, 60%-80%), Acceptable (A, 40%-60%) or Limited (L, lowest 40%): here one might note that, the location within these ranges being set by peer refereeing, the procedure actually combines quantitative and qualitative criteria to establish the rating of the single SRPs.

The Agency rating (R) was then calculated via the Equation

$$R=(N_E+0.8xN_G+0.6xN_A+0.2xN_L)/N_{TOT} \quad (1)$$

and the Agency ranking list was established thereby, getting to the results reported in Table 1.

The ranking list obtained in this way is essentially based on the quality criterion: the average degree of property of the SPRs and their average Impact Factor (IF), shown in the Table, are not involved in Equation (1). While waiting for the final CIVR work, including other context indicators, which would allow "to come to a circumstantial evaluation of the quality, the efficiency and effectiveness with which each research structure operates, and of its actual positioning in the Country", those listed in Table 1 remain the reference numerical indicators for research addicts in Physics, Italian Government and public opinion.

4. Recent advances in the INFN self-evaluation work: the 2006 report to the CVI

The original GLV approach of the self-evaluation work with the triennial periodicity was to

Table 1. The CIVR - established Ranking List for the main Italian Research Funding Agencies in the Area of Physical Sciences with reference to the 2001-2003 period.

Agency	R	E (%)	G	A	L	NSRP	FTE	Av. rop.	Av. IF
INAF a	0.92	97 (66)	44	6	0	147	316	0.57	7.24
INFMb	0.92	222 (64)	108	16	0	346	700	0.38	9.09
INFN	0.89	367 (56)	244	46	3	660	1319	0.23	4.36
CNRc	0.83	65 (38)	78	24	5	172	347	0.49	5.73
ENEAd	0.77	22 (22)	47	27	2	99	168	0.73	2.77

a National Institute of Astrophysics; b National Institute of Structure of Matter Physics; c National Research Council; d National Institute for Energy and Environment.

elaborate the report on the scientific contents of the INFN research (first year: 2001), on its SE&I impact (second year: 2002), and on both of them, in addition to the SRP description cards, on the fourth year (2004), referring to the three previous ones.

Again, the 2005 report was addressing the scientific contents of INFN research in 2004. However, having in mind the CIVR reactions to the CVI reports, the GLV presented to CVI in 2006 a more comprehensive document made of the following parts:

(i) the report on the SE&I impact of INFN research with reference to 2004/2005;

(ii) a collection of numerical tables containing (a) all the information necessary for a complete evaluation of the INFN scientific productivity in 2006; (b) for the first time, a set of quantitative indicators relevant to the SE&I impact of INFN research.

(iii) a novel approach of performing the national and international comparison of the INFN scientific productivity, normalizing to macro-economic indicators. Since the international comparison provides for INFN the natural reference scale, such point represented the actual novelty, allowing to go beyond the uneasy and private-communication practices used in the past to get the necessary data on foreign and international Institutions. The indicators adopted for this purpose were the number of publications (recorded in the ISI database) and the relevant Impact Factor (IF).

A first step was performed by comparing the INFN production to the one in All Disciplines for the 15 EC (EU15) partners, for which the EUROSTAT data are well established. The data were normalized to the Government expenditure for R&D (GERD, also expressed in million PPS, Purchasing Power Standards), and to the number of researchers, both as Head Counts (HC) and as FTE units (see Table 2).

Table 2. Number of papers (N) in All Disciplines authored in 2005 by Scientists from different European Countries (source: ISI database) vs. macro-economic parameters (source: EUROSTAT 2005 Yearbook)

Country	N/GERD (N/106 PPS)	(N/HC Researchers)	N/(FTE Researchers)
France	5.17	0.54	0.78
Germany	6.53	0.48	0.98
Italy	6.02	0.72	1.28
Spain	9.17	0.31	0.57
UK	15.47	—	2.43
EU15	7.17	0.68	1.09
INFN	7.49	0.96	1.80

For a more specific approach, the number of papers was considered which were published by INFN authors in a significant and selected set of international scientific journals dedicated to research in nuclear, sub-nuclear and astro-particle physics (altogether designed as the NPAP sample, see Table 3).

Table 3. Number of papers (N) authored in 2005 by INFN on the NPAP set of Scientific Journals (source: ISI database)

Journal	N
Physical Review C	82
Physical Review D	232
Nuclear Physics A	88
Nuclear Physics B	89
European Journal of Physics A	52
European Journal of Physics C	57
Physics Letters B	134
Journal of Physics G	41
Nuclear Instruments & Meth A	143
Journal of High Energy Physics	103
Classical Quantum Gravity	49
Astroparticle Physics	17
Int. J. Mod. Phys. A	44
Journal of Math Physics	18
Communications in Math. Phys.	7
	1156

The 1156 INFN papers recorded in this Table represent 80% of those with Italian Authors appeared on the same journals , 47% of the 2466 INFN papers recorded for 2005 on the ISI database and 60% of their total Impact Factor, which gives a measurement of how effective the NPAP sample of journals reveals for the present purposes.

The number of INFN papers recorded in the NPAP field was then submitted to the international comparison previously performed for the total number of INFN publications with respect to those in All Disciplines.

It is seen from Table 4 that the share of the INFN scientific production in the NPAP set of journals in 2005 was 20% of the total EU15, comparing well to the ones of France and UK, whereas the one of Germany is higher.

5. Concluding remarks

The ratings of the main National Funding Agencies for the 2001-2003 research in Physical Sciences (see Table 1) turned out to be quite high; in this framework, INFN itself stands as a whole quite close to 90% of Excellency. The fine structure of the rating, and thereby the order of the ranking list, however, can be affected by de *facto combining* (as it was observed in Sect. 3) numerical and qualitative criteria in locating the SRPs on the scale of value shared by the international scientific community. The sharp algebraic criterion represented by Equation (1) should therefore be integrated by other considerations while comparing different Agencies. Nevertheless, on the one hand, peer refereeing still seems the only possible approach for the

Table 4.- Number of Papers (N) published in 2005 on the NPAP set of selected Journals

Country	N
France	1182
Germany	2072
Italy	1440
Spain	706
United Kingdom	1265
EU15	5710
INFN	1156

present purposes. On the other, INFN accepted the CIVR challenge of proving that only what can be measured can be improved, and therefore is preparing to face the future phases of evaluation with a positive attitude.

As to the international comparison performed on the new grounds described in Sect. 4, it was already remarked (see Table 4) that the INFN scientific production in NPAP compares well to the one of the EU15 countries. From Table 2, furthermore, it appears that its productivity indicators are higher than for the All Disciplines average in Italy, pointing out the strong role of the INFN research in our Country.

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