

AVALIAÇÃO DE UNIDADES DE INVESTIGAÇÃO - 1999

Relatório

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1. Exact Sciences / Ciências Exatas

1.1 MATHEMATICS / MATEMÁTICA

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The evaluation covered 21 Units and the site visits took place in July 1999.

I. Methodology

Site visits were opened with an overall presentation by the Unit Leader on the composition of the Unit and its research interests, followed by a brief description of the Unit's research activities during the period 1996-99. Young researchers were invited to come forward and share with the panel some of their recent contributions. The panel engaged the members of the Unit in an informal discussion so as to identify the Unit's vision in terms of future directions of research, planned initiatives, and the difficulties encountered by the Unit in order to pursue their program.

After each site visit the panel reconvened, thoroughly discussed the Unit's status, decided on its classification ranging from Poor to Excellent, and the Unit's report was drafted.

The panel met once with Professor Heitor who clarified the funding mechanisms of the FCT, the objectives of Programmatic Funding, and addressed the overall mission of the panel.

Programmatic Funding was perceived as being focused to make an impact on particular aspects of the research activity of the Unit. Although subgroups within the Unit may be targeted, individual research needs are to be covered by other FCT funding mechanisms. Programmatic funding was allocated under the following guidelines:

- funding for hosting senior researchers with the main purpose of mentoring young researchers in the Unit;
- funding for PhD fellowships to be awarded to Portuguese and foreign prospective students as a recruitment mechanism;
- funding for postdoctoral positions whenever the Unit has the scientific research strength needed to mentor them;
- funding for mobility of postdoctoral fellows in Portugal and abroad so as to maintain a wide spectrum of exposition to international expertise;
- funding to organize summer schools and/or conferences and workshops;
- funding to update depleted libraries;
- funding for auxiliary staff when understaffing is severely impairing the research production of the Unit;
- funding for state-of-the-art equipment when computational capability is an integral part of the Unit's research program.

II. General Comments

Mathematics research in Portugal continues to progress, and significant improvements since the evaluation of 1996 may be observed concerning re-alignment of research interests (e.g. the investment in Computational Algebra in the Centro de Álgebra (Lisboa), the rebirth of Statistics in the Centro de Matemática e Aplicações (Aveiro)), re-structuring and streamlining of certain research Units, development of new international collaborations, etc. Although in its whole Mathematics research in Portugal remains somewhat underdeveloped and uneven relative to some of its western European neighbors, it is fair to say that some Units perform at an international level, participating in international networks, organizing international conferences, summer schools and workshops, and therefore enhancing the Unit's and the country's scientific visibility worldwide. The CIM (Centro Internacional de Matemática) has proven to be an important vehicle to organize summer schools and other high profile activities, and it has been referred to repeatedly as an important presence in the activity of the centers.

The healthy status of Portuguese Mathematics research is reaffirmed by the virtual lack of brain-drain. Nowadays the great majority of young Portuguese researchers who go abroad

to obtain a doctoral degree do return to Portugal, full of energy and bright ideas, and the academic system is still able to re-absorb them.

Indeed, there are centers where the rate of recruitment in the faculty ranks of the hosting institution is increasing exponentially. Although this fact is reassuring for those who wish to be trained outside Portuguese boundaries, it is worrisome in that there are virtually no recruitment strategies, and research needs have seldom any input in the decision process.

Recruitment strategic planning is impaired by the traditional inbreeding still observed in Portuguese academic ranks, as well as by the poor communication links between the Teaching and Education bodies and the research needs of the Units hosted under the institution. Creative teaching and service assignments are often dissociated from the reality of the scientific expertise of the faculty, and this turns out to be a waste of scientific resources.

Sustained investments in Education and Scientific Research are critical for Portugal's continued growth and development. Judicious scientific policies are needed to respond to the challenges imposed on the Portuguese research by its European neighbors and by the progress as a whole.

It will be difficult, if not impossible, to respond to this call without a carefully thought out strategic planning. The number of areas of specialization should be limited mostly to those of greater impact in view of worldwide trends, building from the expertise already existent, and carefully avoiding too much investment in peripheral subjects.

There are areas with worldwide visibility in Mathematics, and certain centers are well established and have demonstrated maturity and excellence in one of more subjects in the discipline. Areas of strength in Portuguese Mathematics include Algebra, Probability and Stochastic Analysis, Differential Equations, Dynamical Systems, and Statistics. A marked preference of young researchers go into Algebra related areas, while the ranks of young analysts are dangerously dwindling. This phenomenon deserves to be investigated. Is this a consequence of curriculum design or better recruitment strategies at the very early stages of college?

Areas of weakness include Computational Mathematics, Numerical Analysis, and core Mathematics, e.g. Number Theory. The latter is essentially not represented in the country. A concentrated effort is required for the first two. Computational Mathematics is of national importance and links with industry will not be possible without a strong Computational Mathematics presence. There are valuable local efforts but their lack of coordination impairs the flourishing of the subject. Numerical Analysis has components in several centers (e.g. Centro de Matemática Aplicada (IST, Lisboa), Centro de Matemática de Coimbra, and, to a lesser extent, Centro de Matemática e Aplicações Fundamentais (Lisboa)), and although the theoretical work is recognized internationally, a computational component is seriously lacking.

Good contacts with centers of excellence worldwide, and creation of critical mass are in order. Only a strategic initiative involving a few universities and centers at the national level may, if carefully planned and granted the necessary financial support, establish a program to develop in Portugal a new generation of high level experts in Computational

Mathematics, including Numerical Modeling, Scientific Computing, Theory of Algorithms, Data Analysis and Approximation Theory. We are on the edge of major unpredictable scientific breakthroughs that will radically transform our lives, ranging from the emergence of nanotechnology to neuroscience. With new problems come new opportunities, and Mathematics has to be well positioned to embrace them. This will require strategic planning, support for work with long-term objectives, breadth across disciplines, while maintaining and strengthening abstract or fundamental Mathematics.

III. Recommendations

1. The Evaluation Process - Site Visit and Reports

The evaluation was focused on the research activities of the Unit. The panel sought to identify the strength of the Unit, major contributions during the last three years, approaches taken to tackle the problems under consideration, the impact of the work in the discipline and across boundaries, new directions to pursue. Often researchers were asked to share with the panel what they perceived to be their major achievement during the period under consideration. The responses were somewhat uneven. Although several (young) researchers were quite articulate in their spontaneous answers, and this greatly stimulated the discussion with the panel and considerably helped the evaluators in their assessment, others were bound by the written report to which the panel already had access.

As a recommendation for future evaluations, written reports and oral presentations could benefit from following the guidelines below.

Written Report:

Written reports were uneven. Some were well presented, but most were poorly organized.

- A report should begin with a mission statement.
- The mission statement should be followed by a list of the Unit's personnel (most recent degree and affiliation).
- A description of the research groups in the Unit should come after an overview of the Unit's objectives which elaborates on the (short) mission statement.
- Each research group should identify the major areas of interest, major accomplishments, list of publications, list of recent PhD graduates and Post-docs mentored.
- The vita of PIs should be put in an Appendix. Vita of other members of the Unit should be left out.
- Funding status of the Unit during the period pertaining to the evaluation should be appended.

Oral Presentation:

- A repetition of the material in the written report should be avoided. Site visits are the only opportunity granted to the panel to get acquainted with the Unit, and to learn more than what was provided by the written material. Therefore the panel

seeks to engage in technical discussions where their expertise may be put to use, and where it may come across more easily the breath of work in the Unit, and possible directions of scientific growing.

- The Unit Leader should summarize requests for funding, and indicate specific priorities for using Programmatic and pluriannual funding.

2. Inbreeding and Internationalization

The inbreeding still existent may make it difficult to hire young researchers from abroad or trained at other institutions. The situation has a few advantages: PhD students may go abroad to complete their degrees without worrying about subsequent job applications, and without having to teach so as to ensure their subsistence. The panel is of the opinion that the negative effects greatly outweigh positive ones:

- although the system is still in a growing mode, there will come a time where faculty ranks will reach a saturation point. Pointed, carefully targeted recruitment will then be necessary, although seriously threatened by the traditional hiring within the faculty ranks of young mathematicians still in early stages of training in that same institution.
- exposure to other research programs and the possibility to interact with other scientists must be strongly encouraged. Mobility and internationalization must be ensured through recruiting in the international arena of post-docs and graduate students, by sending students and post-docs abroad, by facilitating sabbatical leaves at leading foreign research centers, and by inviting foreign senior researchers. Being a small country, there is a need to optimize resources and centers must coordinate their various activities in particular in what concerns arranging visits by leading specialists. This may help broadening the range of topics represented in Portugal and develop internal synergies.

3. Faculty Resources and Teaching

Conflicting calls from research and scholarly work and from teaching expectations continue to prevail. Tensions between research aspirations and host teaching institutions surfaced repeatedly during the visits, mostly in smaller centers away from the biggest cities of Lisboa, Porto and Coimbra. The need for reform is urgent, so as to put universities more in tune with the contemporary research calls.

Activities of researchers in Mathematics in Portugal are intertwined with their teaching duties, as it should be. It is not the education mission that is being challenged or questioned, but the lack of flexibility in recruitment and in the management of teaching duties of each faculty member.

Although the resolution of this problem falls outside the scope of this panel and it requires direct action by the higher administration in the Ministry of Science and Technology and the Ministry of Education, the panel wishes to point out a few issues which may be of help:

- on future evaluations the FCT should invite an administrator at the Ministry of Education to accompany the panel during the visits. This may help this Ministry to

get acquainted with the work, aspirations, and needs that the educators have outside the classroom, and which can only enhance their teaching.

- opening new positions is an effective way, if not the only way, to remedy perceived weaknesses, and to build programs on strategically identified areas.
- teaching duties should be weighted as part of a global package which includes the whole range of activities in which faculty members may be involved : teaching, research, supervision of PhD students, mentoring of post-docs, committee work, leadership positions in the Unit or in other university organizations. The concept of teaching buy out – with clear rules so as to avoid abuses –could introduce flexibility in the duality teaching/research.
- the number of 6 weekly contact (in class) hours is manageable, but it seems to be the exception rather than the rule. Most universities have heavier teaching loads, and particularly worrisome are the teaching loads of young PhD graduates. This may cause their incipient research careers to be destroyed before they are given a chance to succeed. More troublesome are the extended exam periods, the numerous final exams that the same professor must provide for the same course and the same group of students, leaving very little free time at Christmas or during the summer to engage fully in research.
- the introduction of a few rotating teaching-free positions to be occupied temporarily based solely on merit of the research proposal is recommended.

4. Research Areas

Most research Units are well positioned to continue their good work, although not all have resolved satisfactory their internal cohesion. A very small number of Units still comes across as a group of researchers joined together due to historical reasons or geographical proximity. Although often there is a serious justification for keeping a Unit broad in its scientific spectrum, internal synergies should be encouraged so as to identify the Unit's strategic goal. There may be several reasons to re-design the membership in a Unit, among them:

- researchers presently attached to a particular Unit may be better placed if joining another Unit. This may be due either to their scientific profile or due to the institution itself which may not call for a research center in view of its educational mission.
- faculty members in the host institution who are research inactive should free the resources in the Unit in order to allow for consolidation of funding and possible recruitment of members.
- Here, and beyond the day-to-day management duties of the Unit Leader, the Unit Leader must play a pivotal role. In most Units the panel found dynamic and energetic Unit Leaders, although not all of them perceived as part of the call the need to pursue and create new opportunities and to continuously develop the vision of the Unit.

The detailed description of the research activities in each Unit and their areas of interest are left to the individual reports per Unit. Without trying to be exhaustive, the areas covered in a significant way are:

Analysis

PDEs and Dynamical Systems stand out in Centro de Matemática e Aplicações Fundamentais (Lisboa), Centro de Matemática da Universidade do Porto, Centro de Matemática Aplicada (Porto), Centro de Análise Matemática, Geometria e Sistemas Dinâmicos (IST, Lisboa), Centro de Matemática de Coimbra, and Centro de Matemática (Covilhã). Calculus of Variations may be found in Centro de Investigação em Matemática e Aplicações CIMA-UE (Évora) and in Centro de Matemática e Aplicações Fundamentais (Lisboa). Operator Theory and Integral Equations are studied in Centro de Matemática Aplicada (IST, Lisboa).

Foundations and Logic

Category theory and Computational Complexity are carried out in Centro de Matemática e Aplicações Fundamentais (Lisboa) and Centro de Matemática Aplicada (IST, Lisboa).

Algebra and Combinatorics

Semigroups and Multilinear Algebra are heavily represented in Centro de Matemática da Universidade do Porto, Centro de Estruturas Lineares e Combinatórias (Lisboa), Centro de Álgebra (Lisboa), Centro de Matemática de Coimbra, and Centro de Matemática (U. Minho).

Graph Theory and Matroids are being studied in Centro de Matemática e Aplicações Fundamentais (Lisboa), Centro de Análise Matemática, Geometria e Sistemas Dinâmicos (IST, Lisboa), and Centro de Matemática da Universidade do Porto.

Topology and Geometric Analysis

Algebraic Geometry, Microlocal Analysis and Symplectic Geometry are found in Centro de Matemática e Aplicações Fundamentais (Lisboa), Centro de Análise Matemática, Geometria e Sistemas Dinâmicos (IST, Lisboa), and Centro de Matemática da Universidade do Porto.

Operations Research

Combinatorial Optimization and other subjects in this area are pursued by the Centro de Investigação Operacional (Lisboa).

Probability

Stochastic Analysis, Complexity Theory and Mathematical Physics are at the core of Centro de Física e Matemática (Lisboa) and Centro de Ciências Matemáticas (Madeira), and may also be found in Centro de Matemática Aplicada (Porto).

Statistics

Extreme Value Theory and Environmental Statistics are well represented at Centro de Estatística e Aplicações (Lisboa), Centro de Investigação em Matemática e Aplicações CIMA-UE (Évora), Centro de Matemática Aplicada (IST, Lisboa), Centro de Matemática Aplicada (Porto), Centro de Matemática de Coimbra, Centro de Matemática e Aplicações (Aveiro), Centro de Matemática Aplicada (Agronomia, Lisboa), and Centro de Estatística e Gestão de Informação (U. Nova, Lisboa).

History of Mathematics

Some activity in this area may be found in Centro de Matemática e Aplicações Fundamentais (Lisboa), Centro de Matemática de Coimbra, and Centro de Matemática da Universidade do Porto.

Areas of strength have been identified as PDEs, Dynamical Systems, Algebra, Stochastic Analysis and Statistics.

Departing from the previous evaluation of 1996, Mathematical and Applied Statistics comes across now as having considerable potential in Portuguese research. A lot of effort was dedicated during the past 20 years to bring the subject to the point of substantial visibility. This aim has been reached, but there is a continuing need to reinforce this success. Achieving this goal opens a new and pressing challenge to Portuguese statisticians -- they must transform themselves into the gatekeepers between Portugal and the wide exciting arena of contemporary world research in Mathematical Statistics (e.g. wavelets, computationally intensive methods, statistics and machine learning, current international practice in Medical Statistics, and Mathematical Biology).

Computational Algebra is in its incipient stages, being developed at Centro de Álgebra (Lisboa), upon the recommendation of the evaluation panel in 1996. Areas of weakness are Number Theory, Numerical Analysis and Computational Mathematics. Building expertise in Computational Mathematics will require a team effort between the FCT and the Units where Numerical Analysis has a significant presence, Centro de Matemática Aplicada (IST, Lisboa), Centro de Matemática de Coimbra, and, to a lesser extent, Centro de Matemática e Aplicações Fundamentais (Lisboa). The panel recommends that the FCT appoints a Task Force to look into this issue.

5. Interdisciplinary Studies in Mathematics

Research in pairs programs and thematic semesters may be effective in attracting foreign expertise for relatively long periods. This could fit in well as part of the general objectives of a program on interdisciplinary studies in mathematics, a well structured organization with a permanent director, cooperating scientists, long and short term visitors, a small body of postdoctoral researchers, and long term multi purpose, multi disciplinary programs complementing the work of centers. This would serve as a vehicle for bridging Mathematics to other disciplines and to introduce the mathematics community to new, contemporary areas of interest where Mathematics may play a pivotal role. As examples, well rounded thematic periods in Mathematical Biology, Mathematical Finance, and

Computational Mathematics, which fall outside or are at the fringes of the scientific agendas of existing Units, could be offered under this program.

Such an enterprise must be supported and encouraged by the FCT. The panel recommends that the FCT calls for proposals.

6. Funding

Decentralization of budget allocations with respect to the central administration of the host institution is imperative. This constraint is mostly felt in smaller centers away from the major cities.

Portuguese researchers are encouraged to continue teaming with their European partners to apply to European funding, as a way to secure more funding and to strengthen their international visibility and enlarge international scientific contacts.

7. Training of Young Researchers

A few centers are scientifically mature enough so as to justify the supervision of PhD students and the mentoring of post-docs. However, and in order to ensure the well-roundedness of their training, these young researchers should be encouraged at some stage in their training to go abroad for a relatively long period of time. By the same token, a steady stream of foreign visiting scholars should maintain the influx of new ideas, new blood, and could help with the training of graduate students.

The organization of summer schools and concentration periods are recommended on individual Unit's reports.

8. Outreach Activities and Undergraduate Education

Outreach activities and vertical integration of research in the education should be valued and encouraged.

The future of Portuguese research lies in the hands of the Portuguese youth: we can only harvest what we plant. The education of K-12 (kindergarten-high school) students is a national priority. It asks for outreach initiatives, academic programs to challenge gifted children, and the awareness of K-12 teachers to the developments in their discipline. The design of attractive contemporary undergraduate courses, and the preparation of students to pursue research (vertical integration programs) and non academic high profile jobs (industrial internships), require the involvement of research active educators. Active dialogue and cooperation between education and research are imperative, and so is an interaction with the public through the media as a vehicle to promote science.

9. Infrastructural Needs, Human Resources

Restrictions on library budgets impose great impediments on research performance. Major centers have strong, updated libraries, with some exceptions (e.g. Coimbra). Smaller centers out in the country do not have the financial flexibility to attain a reasonably good library which will meet their research needs. A good inter-library network, involving a

centralization of library loans and classification, will resolve this lack of access to reference material.

Understaffed departments and research Units, lacking system managers to handle daily software/hardware problems, and assistant managers with administrative skills including submission of grant proposals and budget operation, force researchers to dedicate part of their time to resolve questions for which they are not qualified, while wasting their real expertise.

Addressing these deficiencies will require direct action from the FCT.

10. Interface with Industry

In most advanced countries the need for skills based externally to the department or the research center, as well as the availability of outside funding, promote interdisciplinarity. In Portugal this is still to become a reality, with little evidence of external funded research in the Mathematical Sciences, with the exception of the areas of Statistics and Operations Research. With the absence of these external incentives, the responsibility for fostering interaction between mathematicians, other scientists, and engineers, bringing Mathematics to bear on (engineering) problems throughout the sciences, and at the same time transferring challenging new problems and ideas to Mathematics, falls on funding agencies. Success depends on the creation of networks of highest quality scientists from inside and outside Mathematics. The FCT should regard the design of mechanisms and incentives to foster the creation of such interactions and networks across disciplines as high priority.

Our thanks go to the FCT staff who worked tirelessly before and during the evaluation process to allow the panel to successfully complete its mission. Our thanks go also to the Portuguese mathematicians who received us with great enthusiasm and high expectations, and who are venturing into contemporary questions with an eye on future challenges.

1.2 PHYSICS / FÍSICA

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Physics in Portugal continues to progress and has reached an ideal stage of development to avail of the recognition, stimulation and support which is available. However, the successful promotion of research continues to be seriously hampered by outdated policies and administrative structures. Reforms of staffing and PhD student enrolment policies, technical infrastructures and technology transfer services are urgently needed.

1. General Appreciation of Physics in Portugal

Our impressions of the progress of physics research in Portugal since the last evaluation in 1996 are very positive. Significant improvements are observed since 1996 concerning international collaborations, general equipment, responsibility of younger scientists in research projects, etc. Most of the Units perform research at an international level, and most of the researchers are involved in international networks, publish in journals of good reputation, present their work at international conferences, and make use of the existing possibilities to engage in exchange visits. In most of the Units one or more senior researchers are often involved in the organization of international conferences and workshops. Also, in fields where large facilities are needed to perform experiments, the links with large international facilities are becoming stronger. This will eventually lead to a stronger presence of Portuguese physics in the international physics community.

Although the coverage of subjects is quite satisfactory in the profile of physics research in Portugal, including a good balance between experimental and theoretical research, the Panel found that there is still some imbalance in the representation of different branches of physics, in particular those at the interfaces of physics with other areas such as biophysics, chemistry, and materials. In the core of physics, an obvious lack is the area of advanced nonlinear and quantum optics. Some of these *lacunae* may already be compensated by activities reviewed by other Panels which deal with engineering, biology, chemistry or materials, but the realm of physics itself would be enhanced by a fuller representation of the

subject as a whole. It is not easy to see how the existing imbalances are best remedied (if the need for this is accepted), and by what agency. In the short term it would be useful simply to analyse the facts, by comparison of the relative weights of subject areas with those in comparable countries.

There is also some imbalance in the geographical distribution of the Units across the country, most of them being concentrated in the littoral, along the Lisbon-Oporto axis (with a concentration of about half of the Units in Lisbon). There exist only two Units out of this axis, respectively associated with the Universities of Évora and Beira Interior, whose creation was supported by the Panel in a previous exercise in 1998 (for this reason, these were not evaluated again in 1999). This geographical imbalance is certainly related to the population distribution and the economical development of the various regions, but it would be useful to stimulate truly excellent developments of physics research all over the country. Wherever there may exist still relatively weak, embryonic physics activity, e.g. a prospective rather than actual Unit or a minor partner, growth and change need to be encouraged.

2. The Research System

2.1 Organization and Management

At the level of the individual researcher or research project, physics in Portugal continues to advance, but the background of institutional regulations and procedures remains quite static. The Research Units lie between these two scales of organisation, so they experience a tension between their ambitious aspirations and the resistance to change of the institutions within which they are imbedded. The need for reform is now urgent, in order to create universities more in tune with the modern age, in which responsibility is devolved, management is flexible and responsive, and career structures are in line with practice in other European countries.

Although many Units succeeded in presenting themselves as a whole, it was clear that a considerable number of Units consist of several independent subgroups, which often follow quite different scientific objectives and possess different levels of qualification. This makes the rating process of the Unit as a whole difficult. In part, this splitting into subgroups results from outdated university human resource management policies, which ensure that staff Assistants can get a tenure track position after completion of a PhD. This has led to too much diversification of research subjects in some Units and to a splitting into subgroups, which in many cases are subcritical and insufficiently funded. The solution to this problem calls for a stronger leadership and maybe also a more definitive Unit concept, with a well defined mission, infrastructure, staff and funding policy. The Units should be structured more hierarchically, and a carefully defined policy should be implemented to elect or nominate the leaders on a regular basis. Funding, for example, should not be distributed on an even basis per PhD. The system of direct funding of individual research teams deprive the Coordinators of the Units of a much needed role to orient the strategy, modify long-lasting historical equilibria, and encourage regrouping of teams. The FCT should allocate to the Coordinator a substantial part of the pluriannual funding, and some programmatic funding, not earmarked, to be used for structural changes in the Unit.

In the 1996 general review of Research Units, it was pointed out that the role of Private Associations is questionable and might well be re-examined. This time the Panel was able to better appreciate the significance of these Associations. They can usefully serve as a vehicle for activities which might otherwise be hampered by the inflexibility of university administrations. This was repeatedly stated to be the essential motivation for their formation. There seem to be few disadvantages to forming such an Association to run a Unit, and the question arises: how is their number to be limited? Might it not be better to address the inflexibility which is their *raison d'être*? This would restore coherence to some Physics Departments.

2.2 Technical Support

In Portugal, the technical infrastructure that supports physics research is very insufficient when compared to the expensive equipment available in the Units. The installation, adaptation, operation and maintenance of the up-to-date equipment available are complex tasks that require adequate technical support. Supporting technicians are very insufficient in their numbers, training and motivation, mainly because the career structure for them is seriously out-of-date and does not compare well with industry. To improve safety, efficiency, productivity, and technical excellence this problem should be remedied urgently.

During the evaluation it became clear that many experimental groups were trying to remedy this problem by applying for “technician fellowships”, which can be allocated for periods of limited duration, not exceeding three years. However, this does not seem to be an efficient way to provide the needed technical assistance. The technical infrastructure should be organised for several Units or, if possible, even for a whole Department. The sharing of these resources would make it possible to provide a more continuous service and probably better salaries, and so to attract more competent technicians who could see better chances for a career. The Units and Departments would have access to a variety of services. Hence, it is suggested to explore ways how common technical infrastructures could be implemented in the present system of Units and Departments.

2.3 International Collaboration

There is a need for the Portuguese Government to continue to respond positively to opportunities for international collaboration, including bilateral agreements and participation in well-developed and successful international collaborations such as in the European Fusion Programme, CERN, ESO, ESA, etc. These will be beneficial in terms of European integration, research results, and the further enhancement of standards in Portugal. It should nevertheless be recognised that not all research areas need such strong international integration, particularly when local industrial connections are involved.

It may be that Portugal needs to review the provisions that it makes to ensure effective briefing and active response to European opportunities. The response of research Units to the 5th Framework Programme seems to have been very limited. This problem is not unique to this country. All over Europe, the 5th Framework Programme has not been taken up enthusiastically by physicists (and others), for a variety of reasons. The emphasis placed on

short term returns, which favours the applied domains, the relentless change of nomenclature, procedures and criteria of the EC research programmes and the reduced success rate of applications tend to induce a kind of fatigue among the applicants. In other countries this has been compensated by the establishment of university European Offices to advise and guide the applicants; in some cases, actual assistance with applications and management of projects and the hiring of expert consultants. If, upon review of the outcome of the first year (i.e. at the end of 1999) it is confirmed that participation is not widespread, this problem must be studied urgently, for two reasons. Firstly, it should be possible to immediately promote and assist such applications by quite simple and cost-effective measures (hire of experts, consultants, support for university advisory services). Secondly, discussion of the prospective 6th Framework Programme already began in September 1999. Portugal needs to offer advice, based on experience, on the general nature of the Programme.

2.4 PhD Student Enrollment

In terms of international comparisons, there is a serious imbalance between staff levels and the general level of PhD student enrollment. One might expect, as a minimum, one student per active senior researcher. Many groups fall far short of this, and look to fill this gap with postdoctoral fellows.

In many research groups, PhD projects have been used to upgrade the competence and status of staff already employed as university “Assistants”. This is commendable, but we should draw attention to the fact that it often disguises the very low level of enrollment of new graduates as PhD candidates. The problem posed by this low level will therefore be exacerbated when this phase of adaptation of institutions is completed.

There is certainly a shortage of available candidates in Portugal, but the whole of Europe should now be seen as a potential source of graduates. The high level of fluency in English is now a very positive factor in attracting them. The FCT should consider taking steps to enhance this inward flow with suitable incentives.

Further, the Panel recommends that the practice of awarding grants to students to go abroad for their PhD research be discontinued immediately. The funds should be reallocated to support research in this country. Wherever such awards are made in other countries they are almost always funded by the host country. The present policy is completely inconsistent with the present needs of universities in Portugal. This is not to say that it was inappropriate in the past, in an earlier phase of development.

3. Interface with Industry and Innovation

For many reasons, interaction with industry is of vital importance to the immediate future of the national research programme. The international trend, strongly reflected in the 5th Framework Programme, is towards direct collaboration with industry. This may be disguised by obscure terminology (such as “sustainable growth”), but in practice it demands straightforward partnership with commercial concerns, or even leadership by them. It is no longer possible to allude to possible (remote) applications if research is to be considered “applied”.

There is however a lack of awareness and information of most research leaders regarding relations with industry: contracts are dramatically rare in regard of the good quality of the technology available; there is little “patent” or “intellectual property” culture.

Portugal offers a few early examples of appropriate mechanisms for applied research. It is surprising that this momentum has not been maintained over a wider front. This may be attributable to the entrenched conservatism of the universities, which is mentioned elsewhere, and also to the fact that Portuguese industry is not yet recognising the importance of R&D. But national policy must also play a role.

The Private Associations make a contribution in this area, but raise further questions regarding their effectiveness.

What is most notably absent is enterprise and initiative at the level of the small start-up company. Typically, such companies might be created in a university “incubation centre” and move to a science park, possibly also associated with the same institution, in the process of evolving from campus company to private corporation. Many of them would simply fail – it is important to recognise and tolerate this. This model is familiar in the U.S., the U.K. and elsewhere. It confers enormous benefit upon: i) the individual academic, who is provided with an outlet for inventions and commercially applicable work; ii) the universities, by enhancing their reputation for serving the needs of society, and directly in terms of income; iii) the national economy, by creating a culture of innovation, and seeds of growth, based on the human resources of its higher-education system. It can be argued that it may detract from core educational values, but there are strong positive arguments to be considered as well, in favour of introducing students to the commercial world. All studies which have been made of experience with this model show that it repays investment many times over, in direct cash/equity terms, apart from any arguments of indirect benefits. (N.B.-A member of the Panel visited Taguspark and was very favourably impressed by this initiative, in which private and public interests combine to promote start-up companies, in synergy with other larger-scale developments).

In Portugal, the problem of the interface university/industry needs to be urgently addressed. The Panel strongly recommends that adequate services be implemented to advise, help and promote technology transfer. Appropriate measures should seek to bring industries and universities together (at the level of technical management) and offer inducements to both to cooperate. It is not enough to address the university side of this problem in isolation; many companies also need to be motivated to recognise the benefits of innovation.

1.3 CHEMISTRY / QUÍMICA

Panel Coordinator:

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Evaluation Panel:

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National Research Council of Canada, CA

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The Chemistry panel evaluated 18 research units, affiliated to seven different universities: Aveiro (two units), Braga (one), Coimbra (three), Lisboa (nine), and Porto (three). The assessment of each unit was based on a detailed report prepared by the unit, describing the activities in a three-year period (1996-1998), and on a site visit. Most site visits included a brief presentation by members of the unit, followed by some discussion, a poster session where the panel members could interact with junior staff and students, and a visit to some laboratories. The duration of each visit varied between 2 and 3 hours.

In a final panel meeting, the units were graded (on a scale from *excellent*, *very good*, *good*, *fair*, or *poor*), and a panel report on each unit was made. These reports were delivered to FCT and later made available to the units.

This brief final report contains some general impressions on Portuguese chemistry arising from the assessment exercise and summarises a number of recommendations. Some of these recommendations are concerned with chemical research and a few with organisational details. The latter should be considered in future similar exercises.

A. General comments

Portuguese chemistry is basically good: the people are very well trained and the work they do is carried out carefully and conscientiously. However, for the most part they are very conservative about what they do. Researchers should be encouraged to strike out more on their own and this should then be reflected in the next assessment exercise. The question relating to collaborations with workers abroad that appears in the FCT document was discussed by the panel; it is now time to rephrase this, so that credit is given for new directions and new work independent of foreign thinking. On the other hand, the panel considers that many Portuguese chemists need to publish more and in the best journals. Publication rates, particularly in the higher prestige journals, are too low. A higher profile from presenting work at international meetings would also be desirable.

Although chemical research in Portugal may have a bright future, as indicated by a number of creative approaches to promote high quality long-term research programs, there are two major problems. The first is the lack of adequate resources. It is difficult to maintain a balance that allows the best units to prosper while, at the same time, addressing regional issues and providing incentives for the weaker units to improve. The second problem is the lack of a significant chemical industry in Portugal. As a result, Portuguese universities may end up training highly qualified personnel for work elsewhere in the European Union. Fortunately, however, there appears to be a growing contact between industry and the universities, for example in areas like cork, wine, and dyestuffs. Some of the units appear to provide assistance to industry, but most do not. There is a similar concern with patent protection. Researchers showed little hostility, but also little general interest, in protecting intellectual property with patents. Nearly everyone regarded the process as difficult and expensive. There is a clear need for a central patent organisation either to provide assistance (information and procedures, some funding, technology evaluation, and due diligence) or to encourage and fund the development of patent centres within the individual universities. The inclusion of industry in planning such arrangements would be beneficial so that potential disagreements over property rights do not discourage industry/university co-operation.

Not all the researchers have the aptitude to do fundamental research. Many are better suited to more applied research. Both are essential in order to link the research programs to industry. The unfortunate tendency is to consider those who do fundamental studies as the “best” scientists. This is not necessarily true. The solution to more practical problems that can create jobs and services requires as much creativity as the solution to more esoteric scientific problems. The key is to decide who should be doing what. Fundamental research has to be based on the search for answers to fundamentally important questions in science.

A major problem of chemical research in Portugal is the scarcity of good libraries. Although in many libraries the space is adequate and the physical facilities range from adequate to very good, many important journals are not subscribed to. Access to

materials not available in the local library is definitely in need of improvement. Photocopies of articles or interlibrary loans of journals and books can be arranged but the service is apparently both slow and unreliable. Some researchers find it faster and more reliable to request copies of articles from their foreign collaborators. A fast and reliable service for the physical sciences that includes all of the country's universities would solve most of the problem.

Quite a lot of chemistry examined by the panel was equipment driven, and there are some races to get bigger and better machines. This is normal, but in some cases the real potential of the equipment, that the units already have access to, has not been utilised. In other cases the calls for new equipment were to enhance the prestige of the unit rather than because something bigger and better was really needed. For instance, the panel had requests for very high field NMR spectrometers, when what was needed was a 250-300 MHz machine with an autosampler for running routine spectra quickly and painlessly. There may be a case for siting one 600 MHz spectrometer in Portugal, close to a really strong bio-organic or bio-inorganic group. That way one could ensure that the people who have demand for it would use it to its full capabilities. Of course, a part of the time of the machine should be arranged to be devoted to other projects. However, very competent technical back-up will need to be provided: without that even the most powerful machine would be wasted.

The panel was very impressed by the openness of the discussions during the visits. The willingness of the unit leaders to conduct their business in front of colleagues and to be corrected in public was very commendable. The role of women in Portuguese chemistry is also to be commended: both the proportion and the leadership.

B. Other comments/recommendations

1. Many units have too many projects for the number of researchers available.
2. Many Portuguese chemists have a high number of communications to conferences and a low number of publications in refereed journals.
3. There is a general lack of safety concerns in chemical laboratories (corridors full of closets, many people do not wear safety glasses, etc.).
4. Permanent technical staff to do routine work is scarce.
5. A large quantity of obsolete equipment needs replacing. The maintenance of equipment is generally not satisfactory.
6. Programs involving collaboration between private companies and research groups should be fostered.

7. There is a lack of mechanical, electronic, and glass blowing workshops.
8. Some units are organised according to the personal relations of staff members/leaders, not necessarily in the interests of scientific progress.
9. Academic staff should be able to continue research and teaching as long as they have interest, ability, and enthusiasm. However, staff above a certain age should not continue to exercise administrative functions, and should be gracefully retired from them. Instead the younger staff members should be encouraged to participate in running the units.

C. Statistics

Based on the reports prepared by the units, the panel co-ordinator made a statistical study of the 18 units evaluated. The panel considered that this information was very important for the assessment exercise and suggests that, in the future, the statistics be provided by the FCT staff and made available before the next assessment.

The tables and plots shown below were reviewed by the unit leaders after the site visit. Several sensible suggestions were made in the review process and it is hoped that they will be followed in the future. For instance, the distribution of publications of a unit by several groups may lead to distortions when inter-group publications exist; in some units the number of permanent staff (PhD) members is over-counted because it includes people who only recently obtained their PhD degree, i.e. they were not staff members of the unit for the full three-year period; “impact factors” vary significantly with the area or even sub-area. Despite these acknowledged shortcomings of the figures, we believe that, by correcting them, the overall picture of Portuguese chemistry would not change dramatically. Although they are necessary for exercises of this type, the interpretation of the statistics needs to be done with considerable circumspection.

Unit	Group	PhDs	SCI Papers	Proceedings	Chapters	Books	Other Pub.	Patents	Papers/PhD	I. Factor	IF/PhD	PhD Theses	MSc Theses	PhD students	MSc students
Instituto de Biotecnologia e Química Fina (UM) (No. 296)	Chemistry of Peptides (1)	7	5	8					0.71	8.14	1.16	1	1	3	1
	Chiral Compounds	5	11	4			1		2.20	17.64	3.61	2	2	2	1
	Heterocyclic Compounds	8	21	2	2				2.63	16.68	1.96	4	3	3	4
	Physical Chemistry and Analytical Chemistry	9	16				6		1.78	29.39	3.27	4	4	2	5
	Total	29	53	14	2	0	7	0	1.83	70.65	2.44	11	10	10	11
<i>(1) IF=1.6 was assigned to 1 paper in Lett. Peptide Sci.</i>															
Centro de Investigação em Química da Universidade do Porto (DQ-FCUP) (No. 81)	Organic Synthesis	3	2						0.67	2.93	0.98		1		
	Free Radical and Food Chemistry	4	3						0.75	3.78	0.95				
	Analytical and Coordination Chemistry	5	4				7		0.80	5.76	1.15	1		3	2
	Interfacial Electrochemistry and Electroanalysis	5	10	1	1	1			2.00	17.67	3.63	2	4	4	
	Thermochemistry	12	33		1		1		2.75	42.26	3.62	3		3	1
	Total	29	52	1	2	1	8	0	1.79	72.40	2.50	6	5	10	3
Laboratório de Química Inorgânica Pura e de Aplicação Interdisc. (DQ-FCUP) (No. 248)	Total	5	47	15	0	0	15	0	9.40	75.66	15.13	3	2	10	3
Centro de Química da Universidade do Porto (ICEITA-UP) (No. 1061)	Total	38	162	0	4		52	0	4.26	210.24	5.53	9	15	34	13
Centro de Química Orgânica, Produtos Naturais e Agroalimentares (DQ-UA) (No. 62) (2)	Total	20	84	35	15	1	12	0	4.20	139.11	6.96	7	9	15	14
<i>(2) IF of EurJOC=3, Sem. Food Anal.=1.6, Heterocycl. Commun.=0.96, J. Porphy. Pthalocyan.=0.6, J. Magn. Reson. Anal.=2.2</i>															
Centro de Química Inorgânica e de Materiais (DQ-UA) (No. 157) (3)	Total	17	129	33	8	1	20	3	7.59	244.50	14.38	8	6	19	3
<i>(3) IF of J. Chem. Phys. Phys. Chem.=1.7 and J. Magn. Reson. An.=2.2</i>															

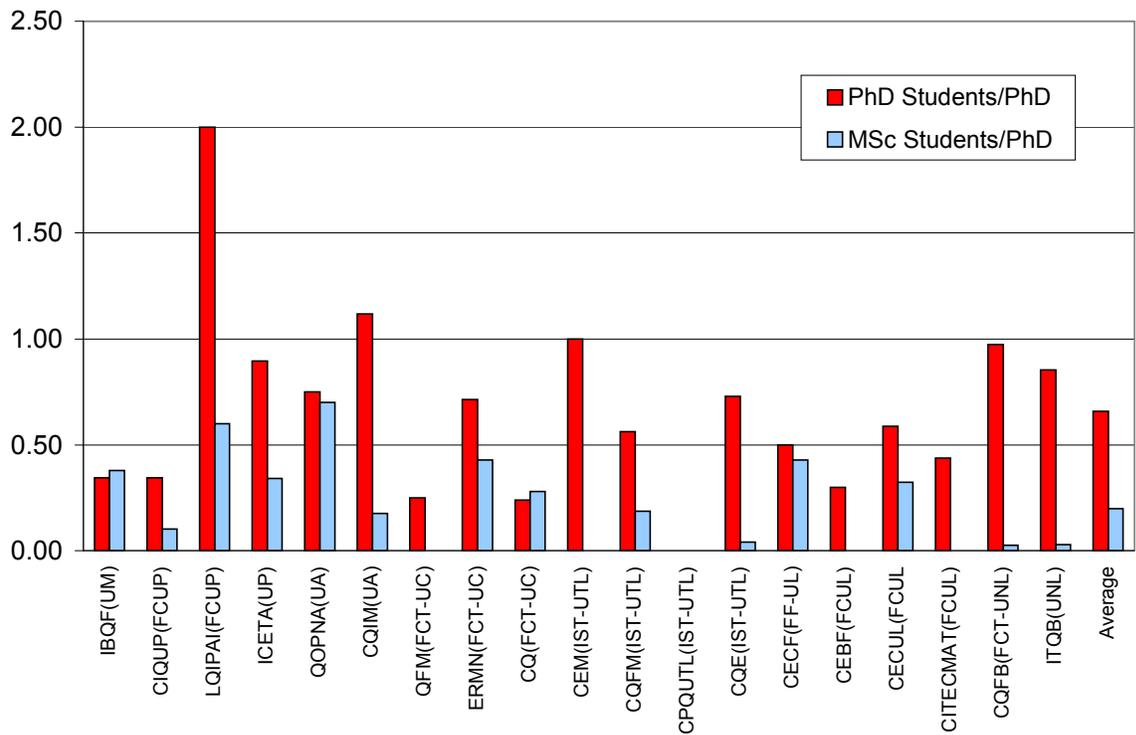
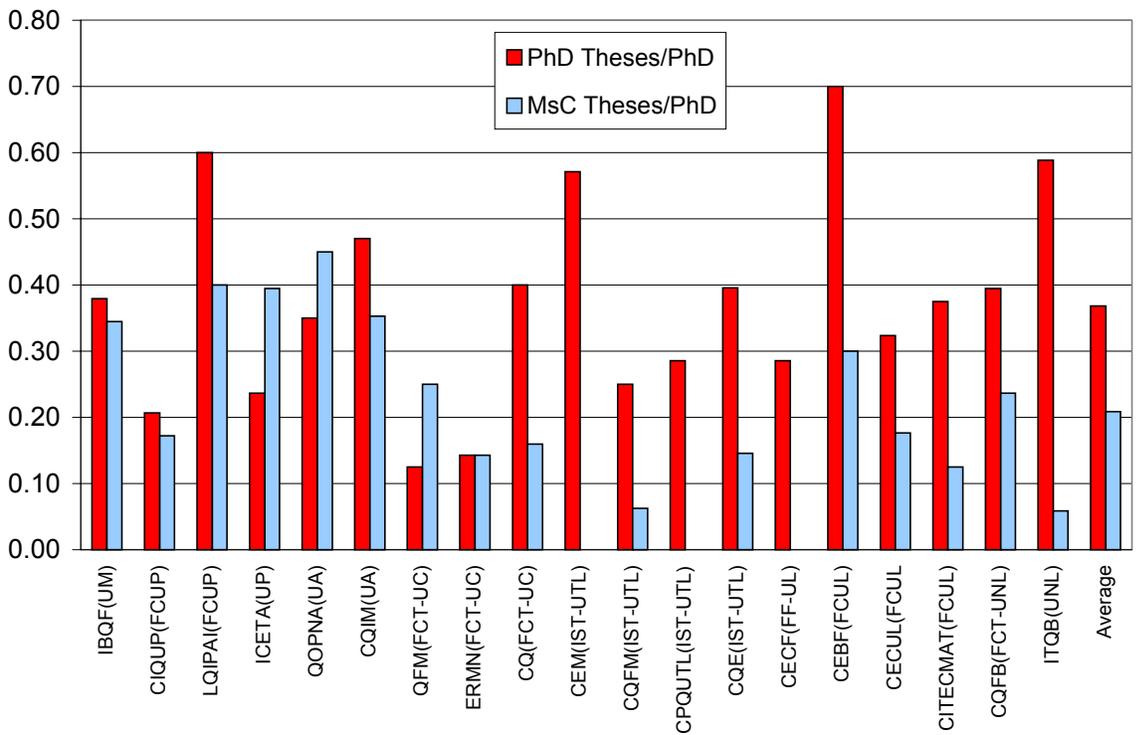
Unit	Group	PhDs	SCI Papers	Proceedings	Chapters	Books	Other Pub.	Patents	Papers/PhD	I. Factor	IF/PhD	PhD Theses	MSc Theses	PhD students	MSc students
Química-Física Molecular (FCT-UC) (No. 70) (4)	Molecular Structure and Dynamics Studies	6	20	3	3	1	7		3.33	27.72	4.62				
	Research on Chemistry Learning and Teaching	2		3	2	1	1		0.00	0.00	0.00				
	Total	8	20	6	5	2	8	0	2.50	30.76	3.85	1	2	2	0
<i>(4) 0 papers were not considered (authors are not in the unit)</i>															
Espectroscopia de RMN (DQ-FCT-UC) (No. 61)	Biomedical NMR and Bioinorganic Chemistry	4	15	1	3		5		3.75	30.74	7.68		1	3	2
	Multinuclear NMR of New Coordination Compounds	2	5			2	1		2.50	5.97	2.99	1		1	
	Structural Biochemistry and Molecular Biophysics	1	1						1.00	3.75	3.75			1	1
	Total	7	21	1	3	2	55	0	3.00	40.46	5.78	1	1	5	3
Centro de Química (DQ-FCT-UC) (No. 313) (5)	Solution Thermodynamics and Interfacial Phenomena	5	9	2	4		1		1.80	11.55	1.28		2	2	5
	Photochemistry and Molecular Spectroscopy	11	40		4	3+1(E)	5		3.64	75.75	6.89	7	1		2
	Chemical Processes and Organic Synthesis	5	14		1		5		2.80	24.80	4.96	2		1	
	Electrochemistry, Diffusion and Thermal Diffusion of Electrolytes	1	3		1		16		3.00	2.27	2.27	1		2	
	Theoretical and Computational Chemistry	5	29		1		1		5.80	81.55	16.31			1	
	Biological Chemistry	3	6		2		1		2.00	24.30	8.10		1		
	Total	25	101	2	13	3+1(E)	29	0	4.04	220.22	8.81	10	4	6	7
<i>(5) IF of Supramol. Sci.=3.19 and Chem. Phys. Reports=0.299</i>															
Centro de Espectrometria de Massa (IST-UTL) (No. 16)	Ionisation and Dissoc. Processes in the Gas Phase: Theory and Applications	4	8	1	1	1	3		2.00	16.65	4.16	4		5	
	Chemistry of Ionic Beams. Energetics	3	10	4	1				3.33	16.16	5.39			2	
	Total	7	18	5	2	1	3	0	2.57	32.80	4.69	4	0	7	0
Centro de Química-Física Molecular (IST-UTL) (No. 85)	Photophysics and Photochemistry of Molecular and Supramolecular Systems	9	51	3	1		10		5.67	123.24	13.69	3		6	
	Surface Spectroscopies and Molecular Dynamics in Solids	6	32	1		1(E)	4		5.33	52.58	8.76	1	1	2	3
	Photobiology of Photosensitizers	1	4	1					4.00	8.04	8.04			1	
	Total	16	81	5	1	1(E)	13	0	5.06	167.22	10.45	4	1	9	3

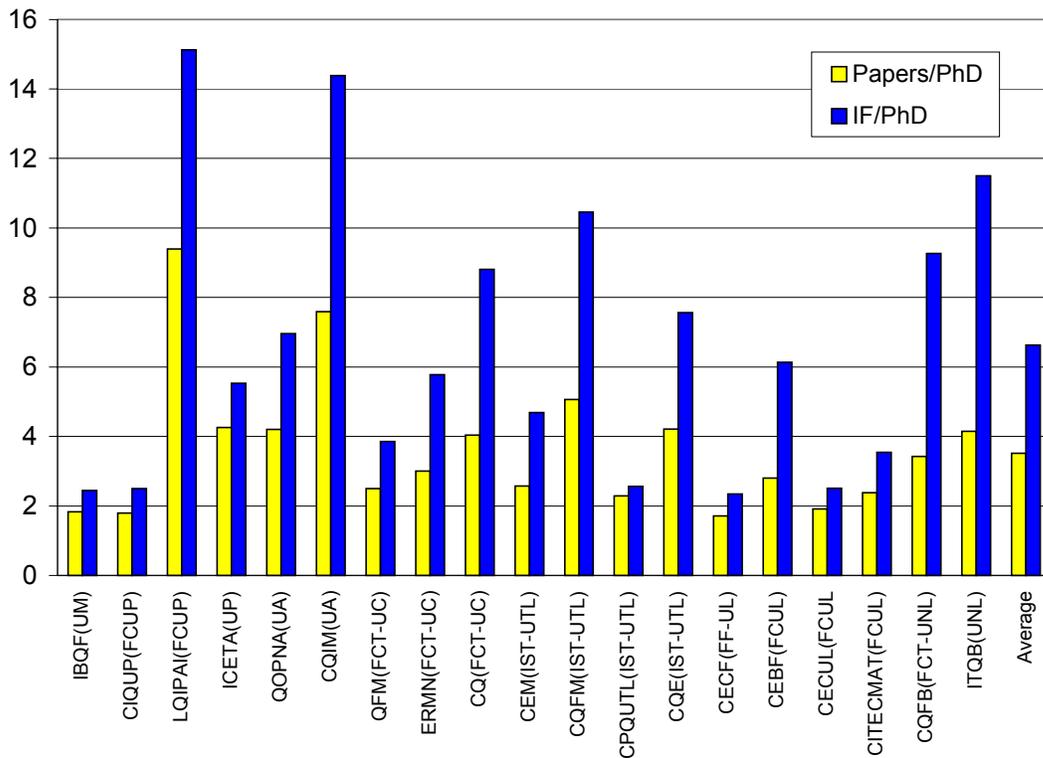
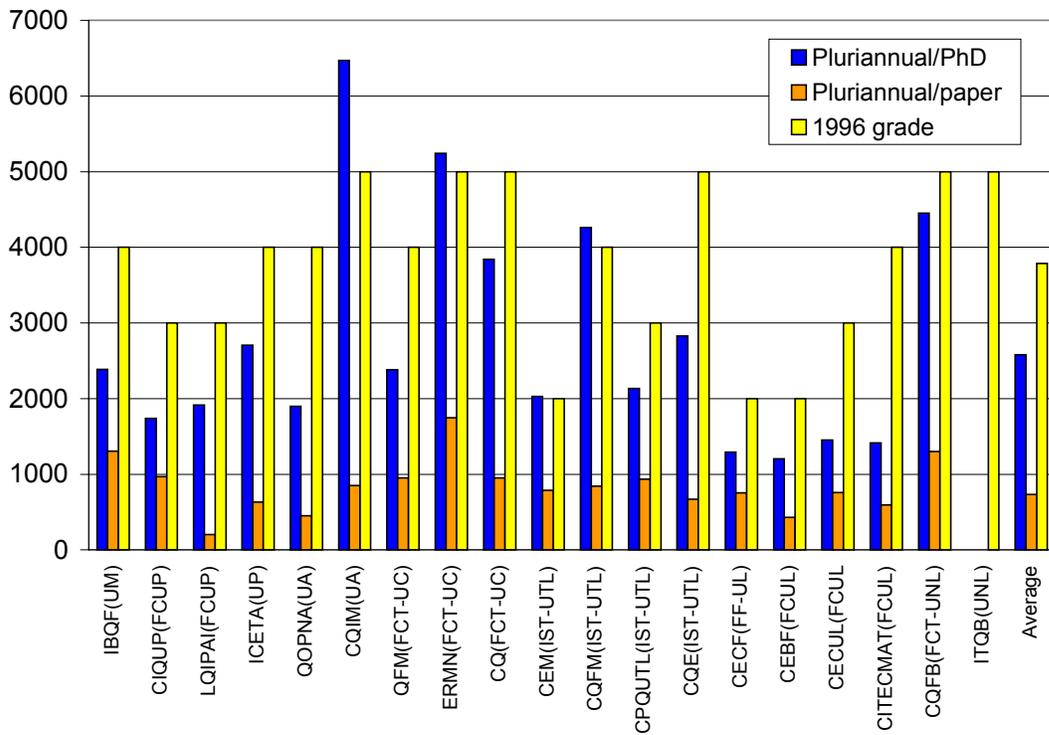
Unit	PhDs	Papers/PhD	IF/PhD	PhD Theses/PhD	MSc Theses/PhD	PhD students/PhD	MSc students/PhD	Pluriannual and Programatic	Pluriannual/PhD	Pluriannual/Paper	1996
IBQF(UM)	29	1.83	2.44	0.38	0.34	0.34	0.38	69174	2385	1305	4000
CIQUP(FCUP)	29	1.79	2.50	0.21	0.17	0.34	0.10	50397	1738	969	3000
LQIPAI(FCUP)	5	9.40	15.13	0.60	0.40	2.00	0.60	9566	1913	204	3000
ICETA(UP)	38	4.26	5.53	0.24	0.39	0.89	0.34	102833	2706	635	4000
QOPNA(UA)	20	4.20	6.96	0.35	0.45	0.75	0.70	38000	1900	452	4000
CQIM(UA)	17	7.59	14.38	0.47	0.35	1.12	0.18	110000	6471	853	5000
QFM(FCT-UC)	8	2.5	3.85	0.13	0.25	0.25	0.00	19055	2382	953	4000
ERMN(FCT-UC)	7	3.00	5.78	0.14	0.14	0.71	0.43	36679	5240	1747	5000
CQ(FCT-UC)	25	4.04	8.81	0.40	0.16	0.24	0.28	96000	3840	950	5000
CEM(IST-UTL)	7	2.57	4.69	0.57	0.00	1.00	0.00	14196	2028	789	2000
CQFM(IST-UTL)	16	5.06	10.45	0.25	0.06	0.56	0.19	68181	4261	842	4000
CPQUTL(IST-UTL)	7	2.29	2.56	0.29	0.00	0.00	0.00	14943	2135	934	3000
CQE(IST-UTL)	48	4.21	7.56	0.40	0.15	0.73	0.04	135727	2828	672	5000
CECF(FF-UL)	14	1.71	2.34	0.29	0.00	0.50	0.43	18093	1292	754	2000
CEBF(FCUL)	10	2.80	6.13	0.70	0.30	0.30	0.00	12026	1203	430	2000
CECUL(FCUL)	34	1.91	2.51	0.32	0.18	0.59	0.32	49467	1455	761	3000
CITECMAT(FCUL)	16	2.38	3.55	0.38	0.13	0.44	0.00	22660	1416	596	4000
CQFB(FCT-UNL)	38	3.42	9.26	0.39	0.24	0.97	0.03	169130	4451	1301	5000
ITQB(UNL)	34	4.15	11.5	0.59	0.06	0.85	0.03		0		5000
Average	21.2	3.51	6.63	0.37	0.21	0.66	0.20	57563	2577	734	3789

	PhDs	SCI Papers	IF	PhD Theses	MSc Theses	PhD Students	MSc Students	Pluriannual*
Totals	402	1412	2663.76	148	84	265	80	1036127

**Estimated

*Does not include ITQB





2. Natural and Environmental Sciences / Ciências Naturais e do Ambiente

2.1 BIOLOGICAL SCIENCES / CIÊNCIAS BIOLÓGICAS

Panel Coordinator:

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Vrije Universiteit, Amsterdam, NL

Peter Calow
University of Sheffield, UK

William J. Brammar
University of Leicester, UK

1. General comments for each of the two areas

1.1. Area of Ecology

(Units: 45, 63, 87, 137, 282, 72, 329)

Ecology is relatively well represented within the Biological Sciences in Portugal. In fact, more than one half of the research efforts reviewed by the panel can be said to belong to one of the ecological sciences in the broad sense (systems ecology, biosystematics, population biology, conservation, etc.). Several research units address questions related to the “montado” ecosystem, which is a characteristic element of the continental Portuguese landscape. Other groups deal with fresh water ecology, marine ecology and behavioural ecology. The emphasis on ecological sciences in Portuguese biology seems to be partly due to a large share of field work, monitoring and species description for purposes of conservation. Consequently, there is relatively little experimental work in ecology (e.g., ecophysiology), although there are some good studies on ecotoxicology in Coimbra and **behavioral/reproductive** ecology in Lisbon and Funchal. Some ecological groups in Portugal are now developing molecular laboratories to address questions of population structure and mechanisms of reproductions; this development is encouraged by the panel.

Groups working on plant, animal, fungal and algal taxonomy are mostly in a difficult position. The panel recognizes the importance of taxonomy and biosystematics as a basic discipline of biology, with a direct relevance for ecology. Given the international attention paid to the issue of biodiversity, there is a general responsibility for Portuguese science to protect the valuable systematic knowledge that is still present within these groups. Some of the groups also maintain valuable collections and botanical gardens, which obviously require continuous expenses for skilled personnel maintaining these facilities. It is felt that the groups involved need to renew their scientific mission, develop modern methods of taxonomy, including molecular techniques, and so increase their scientific status.

Many ecological groups in Portugal conduct projects with an applied goal (environmental pollution, water quality assessment, landscape management). The panel appreciates the effort of these groups to support the solution of societal problems, however, the execution of applied projects should not lead away from the fundamental scientific base. In some cases it will be possible to separate the fundamental scientific studies from services offered to external parties, and to capitalize on these services.

The panel also observes that there is relatively little attention for theoretical biology in Portugal. Theoretical biology not only involves biostatistics and data analysis, but also the development of general and specific models that inspire and guide experimental work. It is recommended that some of the groups **take** up the challenge to fill this apparently empty niche.

For the future, the prospect of most of the ecological groups in Portugal is good, although some must work hard to increase their scientific quality and output. Issues receiving attention should be:

1) Further implementation of methodological innovations (molecular techniques), 2) separation of applied and fundamental problems, and 3) development of a stronger theoretical base, including theory-driven experimental research.

1.2. Area of Biochemistry / Cell Physiology / Genetics

(Units: 41, 132, 262, 272, 274)

This panel looked at five units covering areas of Biochemistry, Cell Physiology and Genetics, including microbial and plant biology, but not mammalian systems. This sample of research units is too small to make significant generalizations, particularly since it seems that there are other research units evaluated outside of this panel that **encompass** considerable scientific activity in Biology, and which are being reviewed by the Health Science and Biotechnology panels.

Areas covered and quality

- Microbial physiology and genetics are well covered with strength in bacterial genetics at ITQB, and Yeast physiology at the University of Minho and the New University of Lisbon.
- Protein biochemistry is strong at ITQB where it is well integrated with Molecular Genetics.
- Hints of strength in Plant Biology were detected at ITQB and at the University of Minho, but these groups are small and there exists no sufficient critical mass in anyone .
- Leadership is a critical requirement and a major contributor to those units with outstanding work. Several units have highly qualified individuals, but are not performing well because of lack of appropriate leadership. This latter criticism also applies to the ecological areas.

Recommendations

The panel recognizes that Biology is increasingly dependent on expensive high technology equipment, and it is not practical for every group to have this equipment, but it is essential that everyone should have access to it if they are to be able to carry out internationally competitive science. We, therefore, recommend the establishment of national **centers** where access to the necessary equipment and expertise can be provided.

There will be a particular need for equipment associated with the use of DNA microarrays and equipment for proteomics. Associated with these technical developments will be an increased need for expertise in bioinformatics.

2.2 EARTH AND SPACE SCIENCES / CIÊNCIAS DA TERRA E DO ESPAÇO

Panel Coordinator:

Brian A. Sturt

Geological Survey of Norway, Trondheim, Norway

Evaluation Panel:

Finn Surlyk

Geological Institut University of Copenhagen, Denmark

Heiki Papunen

Geological Institute University of Turku, Finland

Jan Hertogen

Geological Institute University of Leuven, B

Paul Ryan

University College Galway, IR

The evaluation of the Earth and Space Sciences units, partially funded by the Portuguese Foundation for Science and Technology, was carried out in the first half of November 1999, by an International Panel. This panel had the following composition:

General Comments on Arrangements

On the whole the arrangements made by the staff of the Foundation were satisfactory, but the schedule of the evaluation round was far too tightly packed, and visits to individual major units should have been restricted to one per day. This tight packing gave little time for one of the most important parts of the evaluation, namely: sufficient time to discuss in depth the merits and also criticisms of the units visited. This meant that the panel was constantly working late into the nights, and always feeling an intense time pressure, with little or no time to relax. Our opinion was that the period was probably 3-4 days too short, considering the amount and range of subject matter covered by the units visited. Much time was also spent in travelling, which could {to some extent} to a large part have been avoided with a better planned scheduling. I would recommend to the Foundation that this is a matter that should be given serious consideration in relation to subsequent evaluations. We were, however, impressed by the courtesy and helpfulness of the various staff members of the Foundation that we encountered on our travels, and were extremely pleased by the high standard of the hotel accommodation provided.

General comments on the Evaluation

All of the units were visited, and in general they were well prepared. The standard of the scientific research was in the main unexpectedly good but also somewhat uneven. The same can be said for the manner in which many of the units were organised. Unfortunately, however, there were a few units where the organisational standard was well below that which should be expected, either at a national or especially at an international level. This latter we consider as a serious matter as poor organisation impedes the effective development of scientific research, and is particularly discouraging and often frustrating, not least for the younger scientists. It is understood, that the choice of unit coordinators is very much the responsibility of the universities concerned, but we regard the poor administration of scientific units to be a negative factor in the attempt to achieve high international status for Portuguese Earth and Space sciences. This matter is commented on in detail in the Panel assessments, and should be addressed by the Foundation to the university authorities concerned.

We found, as the result of our visits, an enormous variation in the adequacy of office and laboratory accommodation and in the general standard of facilities, provided by the universities, for the various units. This varied from excellent to poor, and unfortunately in a disturbing number of cases was well below those standards that should be expected for academic institutions in Europe. Certain institutes had virtually no office space for graduate students, and highly inadequate office accommodation for academic staff members at all levels. These are again matters where the panel considers that the Foundation should bring pressure to bear on the relevant university authorities, to radically improve the situation. There was generally also a problem concerning both a lack of essential equipment, including PCs, and that of the replacement of aged or obsolete equipment. Here both the Foundation and the university authorities should help. The panel considers that, with few exceptions, the provision of technical personnel and assistance was woefully inadequate, and well below that we would regard as having attained critical mass. This is the case, especially seen in relation to comparable institutions, i.e. in the countries that we as a panel represent.

We were also concerned with the low level of availability of Ph.D. grants, post-doctoral fellowships (both national and international), and an almost complete lack of relatively short-term visiting professorships. We have also recommendations concerning the format of the Ph.D. examination, which we believe will improve the lot of the younger researchers.

In spite of all the difficulties, we found a level of enthusiasm for scientific research which can only be commended, and which must form a very good basis on which to build. We commend also those units, which have achieved considerable degrees of inter-disciplinary cooperation. The scientific levels of the best units and also of the best individual researchers (independent of the units to which they belong), was of good or very good international standards. This, perhaps not surprisingly, reflects the degree of international contacts and cooperative projects. A number of the individual scientists are certainly in the international top flight and well recognized in the international community for their contributions to knowledge.

We were especially impressed by the efforts, by many units, to bring knowledge of the Earth and Space Sciences to the schools and the general public; and in this field Portugal

looks set to achieve high international status.

A number of more detailed comments are given below:

General Comments

◆ The standard of Earth and Space scientific research was, at least reasonably good in all of the units visited, although in some cases there was considerable variation in standards between sub-groups. A number of units had at least one leading-edge scientist on their staffs and this was indeed reflected in the general standards of the scientific research of the groups. There was a considerable amount of enthusiasm in most of the unit, shown by researchers and graduate students at all levels. Within certain units, important schools with a high international reputation have developed. Examples of these are **as** follows: *earthquake studies and marine geophysics* (unit 170), *coal geology and petrology/fluid inclusion studies* (unit 39), *clay minerals* (unit 254), *structural geology* (unit 32), *granite petrology and Mesozoic stratigraphy* (unit 73), *vertebrate and human palaeontology, related stratigraphy and Mesolithic palaeoanthropology* (unit 164), *physics and chemistry of porous surfaces* (unit 78), *meteorology, particularly aerosols* (unit 78) and *geodesy* (unit 190). We consider this to be a healthy development, though improvements could be made in developing of both national and international networks.

◆ We were specially impressed by the programmes, which are directed towards increasing public awareness in the Earth and Space Sciences. Particularly, with reference for improving High School teaching in these subjects, where we consider *Portugal to be in advance of a number of other European countries*. This was a feature of many units, though we would particularly commend the efforts made, partly in cooperation, at Univ. Minho (unit 274) and the Astronomical Observatory, Porto (unit 190), and also those at the Institute of Geophysics, Lisbon (unit 170). The activities of unit 116 in the development of the Lourinha Museum, and the creative use of the Internet (in cooperation with Univ. Minho) to broadcast scientific knowledge to a more general public, are worthy of mention.

◆ One of the main criteria by which it is possible to evaluate the success of research groups is via their ability to publish their results in peer-reviewed international journals. We found that this was also the opinion of most of the scientists that we met during our visits. The publication record of the various units was found to be highly variable, though scientists in some of the units have achieved a high level of exposure in recognized international journals. Generally, however, too much is being published in what we would consider soft publications. It is important, for status and recognition by the international scientific community, that the publication of important results should be directed towards international journals, and preferably in English. We are of the unanimous opinion that far *too many* of the publications from the units are written in the Portuguese language. Much of such publication is in journals issued by the institutes and in national publications. This we consider to be an obstacle in the internationalization of research, and would recommend that the institutes concerned and the national Portuguese Earth and Space Science journals should actively encourage publication in the English language. We are naturally aware. However, of the need to publish the more popularized scientific communications in the national language, and regard this as important. We will return to this point concerning

publication language, in our considerations of possible improvements of the form of the Ph.D examination.

◆ It is obvious that most of the units understand the importance of international cooperation in science, and considerable efforts have been made in terms of participation in international meetings/symposia. Attendance at such meetings, especially with lectures or posters is important. It is, however, only part of the equation and real and meaningful cooperation in well-designed projects of international standard must be the prime objective. Certain of the units have a very active cooperation in international projects, which is to be commended. However, much more can be achieved both by participation in international projects, and not least by creating a heavier involvement of researchers from abroad in national projects within Portugal. The latter, should, in fact, be given considerable priority as it increases the international exposure of Portuguese Earth and Space sciences, on their own home ground. An increase in the number of shorter visits to research groups abroad, particularly for younger scientists, is strongly recommended. These would be primarily defined as working visits on joint projects, and could also serve to heighten competence in new techniques and methods

◆ We are deeply concerned at the total lack of Research Assistant positions in the units, i.e. attached to individual projects or senior researchers. This does not allow for the more sophisticated development of a number of important projects. Senior researchers are often too tied up with routine matters in such projects, where the availability of a full-time research assistant (3-4 year appointment) would allow for better continuity in projects. It would at the same time provide research positions for promising Ph.D. candidates.

◆ There would appear to be a general *lack of funding* for post-doctoral and full-time research stipend positions (3-4 years) in Earth and Space Sciences within Portugal. This is a standard feature in most European countries, and it allows very promising recently completed Ph.D candidates to undertake virtually full-time research, for a limited period, with only limited teaching responsibilities.

◆ The remarks made, in the two preceding points, are engendered by the *de facto* status of many of the Ph.D. candidates we encountered. The majority of these are in junior teaching positions with exceptionally high teaching loads. This is a negative factor and produces considerable delays in the completion of Ph.D. theses, and has often a debilitating effect on the candidate's research. This will be discussed later.

◆ We identify a particular need for funding to be made available for International Guest Professorships, where international experts (from abroad) are invited to be at one or more units for limited periods (0.5-3 months). They should be expected to involve themselves in the current research of such unit, and also hold short courses, seminars etc.

◆ In a similar vein, we identify a particular need for the funding of international post-doctoral fellowships, where young foreign scientists, who have recently completed their Ph.Ds, can apply for such fellowships for a 1-3 year period. This is important not only for those individuals but also for the Portuguese Ph.D students.

◆ We are concerned that at two of the units (units 94 and 234) the leaders, who are

dominating figures, are both close to retirement, and that no properly developed future strategies have yet been formulated.

II Facilities and Equipment

◆ The standards of on-site facilities, both for academic staff and not least for Ph.D and M.Sc. students, are extremely diverse. They range from good e.g. at University of Minho (unit 274) and the Geological Institute, University of Porto (unit 254), to extremely poor e.g. the Geological Institute, University of Lisbon (units 32 and 263), and the Astronomical Observatory (unit 190) attached to the University of Porto. In the case of the Geological Institute of the University of Lisbon we were informed that there are plans to move into new improved premises, but there have been a number of delays, partly of a bureaucratic nature. In the case of the Astronomical Observatory they have an unfortunate political situation, in being an institution of national importance, that is attached to the University of Porto. This has produced problems both as regards the standard and state of the accommodation in which the staff works, and the technical assistance available (they have no full-time technicians). In spite of their difficulties this is a unit which produces very good work, and needs assistance from the Foundation and the University of Porto. Quite a number of the units suffer from poor or outdated laboratory facilities, at the institutes where they are housed (particularly note units 32, 73, 116, and 263). The Foundation should urge the universities who house units with inadequate office accommodation and laboratory facilities to take *urgent action* in this matter, as it is not conducive to good scientific development.

◆ Similar conditions were found in relation to laboratory developments. We are aware that the universities are responsible for the laboratory space and services, and for a major part of the equipment investment, and that the Foundation is only responsible for part of the scientific research investment budget. We have in our panel reports, indicated the cases where the laboratories require major investments both in laboratory accommodation and in equipment, and would suggest that the Foundation should assist with funding and bring pressure to bear on the relevant university authorities, to improve the situation.

◆ We became aware of the very inadequate technical staffing at a number of the units visited, and indeed at some units there is no skilled technical staff available at all. This has the effect that the often highly capable and enthusiastic academic staff (including professors), have to use much time in doing routine technical jobs which should normally be carried out by technical staff. This is highly detrimental to both the scientific research programmes and in the development of Ph.D. students. We have in our reports indicated those units where such an injection of a technical staff component would be important. We would suggest that the Foundation establish a dialogue with such units and the relevant university authorities to alleviate what we consider to be a pressing matter, which is detrimental to scientific development.

◆ There is a pressing need for investment in relatively minor equipment items <50.000 cintos, in part to replace outmoded, broken-down or obsolete equipment including field vehicles. The latter is a matter of some importance in a field subject such as the Earth Sciences. We were surprised at the low level of investment, with notable exceptions in IT-technology, e.g. units 94 and 274, and at a number of units there was a considerable

shortage of even simple PC-systems. It was particularly surprising to find senior staff members having to share PCs. For certain units this was especially unsatisfactory in relation to facilities for graduate students.

- ◆ Generally there is a national need, for major research equipment investments for advanced analytical techniques and other heavy investment items, and much requires to be done in this direction. A certain part of this can be made in an inter-disciplinary mode, within individual universities. An example of where this has been successfully done is at the University of Minho, where an electron microscope facility is shared between Earth and Biological Sciences.

- ◆ Another planned development which we were told about, this time outside of the university system, is the expected installation of an advanced electron microprobe facility at the Geological Survey (IGM) laboratories in Porto. In this latter case it is expected that, there will be the possibility for time-sharing with the Earth Science departments, in the Porto region. Such developments should be encouraged by the Foundation.

- ◆ At the University of Aveiro (unit 483), a mass-spectograph facility, intended for radiometric age determination, has recently been installed. This represents a unique facility in Portugal, which is long overdue. This should be seen also in a national context for common benefit. The Foundation is recommended to establish a dialogue with unit no. 483 (Aveiro) and units at other universities, to establish how this can best be achieved. It is obvious that much can be gained of mutual benefit by such arrangements, and the Foundation should encourage and promote such initiatives, possibly as a National Laboratory.

- ◆ The Foundation should also consider establishing a dialogue with the units, the university authorities, and other scientific organizations including the Geological Survey (IGM), to plan for the establishment of *national laboratory facilities*. This is especially important, where a particularly heavy investment is required for both equipment and/or technical support staff. Providing the appropriate ground-rules are established at the beginning, such national laboratories can be established at either a university or at another national institution, e.g. the Geological Survey (IGM). Such arrangements are a standard feature in a number of European countries.

III Current situation for MSc. and Ph.D. students: suggestions for improvement

- ◆ Too many young scientists studying for the Ph.D degree are employed as teaching assistants. We found that this gave the majority of such young scientist an often far too high teaching load. This has resulted in that the average age, in Earth and Space Sciences, for the finishing of the Ph.D degree is in the mid-late 30's. This is in our opinion far too late for the starting out on a scientist's main academic career. In most of Europe the average age, for completed Ph.Ds, lies between 25-30 years. More Ph.D stipends should also be made available, for Earth and Space Sciences.

- ◆ We suggest that Ph.D theses submitted as a collection of papers, in part already published, and with an introductory connecting text should become *common practice* in Portuguese Universities. We gather that this would be within the existing requirements for

such degrees. This will have the advantage that young scientists, will begin their publishing career much earlier than at present, and also complete their Ph.Ds considerably earlier than at present. Denmark is a good example of this method of Ph.D. submission, and there is also a stipulation that the work is presented in the English language. The latter has the further advantage that one or more of the examination committee can be drawn from the international community

- ◆ Post-doctoral grants and research assistantships (1-3 years) should be made available within Portugal, on a competitive basis. In other European countries this is a very important part of the general scientific scene, and allows for a deepening of the younger scientists work, and provides a greater degree of continuity in major projects

- ◆ In the introductory remarks we have noted the need for an effective visiting professor programme. This is most important for Ph.D. and M.Sc. students, as it should provide them with direct connection with international science via short courses, seminars etc. It also provides an opportunity for discussing their own research problems with a neutral expert, which can only be an advantage. This and the point below are also important in improving standards.

- ◆ We are concerned to see that too few of the graduate students spend part or all of their Ph.D. period abroad at another university or research institute. We were told, at virtually all of the units that this was difficult because of the heavy teaching loads, and also because of the general age structure of the Ph.D candidates. This point has been mentioned above.

It is our opinion that there have been considerable improvements in the level of scientific research in Portuguese Earth and Space Sciences since the previous evaluation. We as a panel appreciated our contacts with the Portuguese academic milieu, and consider that a very good basis for further improvement has been established. Much can still be accomplished in terms of both national and international net-working, We realize that assistance from the Foundation and the universities is very important, and I have outlined above the main problems that require to be tackled. Certain of these problems are the primary responsibility of the universities, though the Foundation is urged to establish a dialogue with the units concerned and the respective university authorities to address these matters.

We would like to take this opportunity of wishing our Portuguese colleagues all possible success in the future.

Prof. Brian A. Sturt (Panel Coordinator) Chief Scientist, Geological Survey of Norway

2.3 MARINE SCIENCES / CIÊNCIAS DO MAR

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Based on the individual unit evaluations, complemented by in-situ observations and exchange of views with their personnel, the Panel identified some issues that merit special attention.

The order in which they are presented is a random one and should not be considered as reflecting priorities. These General Comments may apply to specific situations or, in some cases, apply to the general field of Marine S&T in Portugal.

The Comments do not necessarily provide answers to the identified issues but rather intend to stimulate further consideration of the matters.

1. Technicians

Many institutions need well-trained technicians under *long-term contracts* who can take charge of management of laboratories, equipment and data, as well as running field operations. Their work would allow scientists to devote their time more to science and education. Different arrangements are applied in Europe and the Panel feels that it would be beneficial to consider them as a basis for the establishment of a flexible scheme adapted to the Portuguese situation. Such an administrative scheme may be developed taking advantage of the concept of “Associated Laboratory” to be designated by the Ministry of Science and Technology.

2. Vessels

Portuguese scientific institutions carry out most of their work in coastal areas or in estuaries. Their need for seagoing platforms can often be met with small boats (ca. 10 m), but work on open coastlines or on the shelf requires medium size vessels (ca. 25 m), equipped with laboratory space, winches and medium heavy equipment. Ideally, there should be two such ships, *attached to Universities*, in Portugal’s mainland: i) one for the Algarve and central coast south of the Tagus river; and, ii) one for the northern coast (Porto, Aveiro). In the Azores there is already a suitable vessel. Institutions should operate the vessels on a time- and cost-sharing basis and in accordance to a mutually agreed plan. This is a costly and far reaching decision which should be carefully considered against a realistic plan of action and an objective evaluation of requirements and capacities, particularly regarding research programmes and training of specialised human resources and as a complement to the existing oceanic fleet.

In this context the Panel recognised as a step in the right direction the intention of using the National Intersectorial Oceanographic Commission to maintain a *comprehensive national research vessels co-ordination system* for optimising the use of all sea going platforms. For reasons of economy and efficiency the Panel recommends also that special attention should be given to the establishment of a *national research vessel facility* for the purpose of maintenance of ships, their standard equipment and other necessary services.

3. Post Docs

Post Doc positions are in most countries considered an important opportunity for particularly gifted young Ph.D.s to continue their specialisation, often in other national laboratories or foreign countries. During the Post Doc period (2-3 years) the scientist is considered as a staff member of the home institution, but the candidates must be protected from heavy burdens of teaching, administration or other responsibilities of the institution. In the selection of candidates for Post Doc positions national needs and thematic relevance must be considered in addition to intellectual qualifications, which implies that a *strategy for future employment* should be formulated.

4. Visiting Professors/Consultants

The efforts to further encourage the selection of a limited number of research fields according to existing competencies and strategic consideration should be continued. At this stage of the process of strengthening Portuguese MS&T capacities, particularly in priority areas not yet adequately covered, the selection and use of *visiting Professors/consultants* could enhance local efforts if they are fully integrated in the relevant projects and teams and correspond to a recognised need by the interested parties. Such an approach might help Portugal develop its emerging leadership in certain fields by inviting highly qualified experts interested in that collaboration because of the specific field of work or the particular opportunities presented by location.

5. 1. Centres of excellence

The objective of “excellence” must be an objective of all centres. “Centres of excellence” are developed, not established, and it is important that such centres be considered excellent beyond national boundaries. National authorities should evaluate which of the existing national research units might have potential for development into a “centre of excellence” or, on a very selective base, become the nucleus of an “*international facility or focal centre*”. Consideration could be given to the specific location of some centres to try and make them “focal centres” for Europe. In this context, it should be considered to provide special *incentives* to the most promising units, which have an adequate size and recognised good/prominent leadership (scientific and managerial). It is not appropriate for the Panel, with its limited knowledge of the situation in Portuguese marine science, to make specific suggestions in this area.

5.2. International Centres/Focal Centres

However, the Panel feels that the University of the Azores may offer potential for a so called “international centre”/“focal centre” (eg. European Centre). The Panel noted the geographic location of the so-called Large Scale-Facilities (LSF) of the European Commission, and found that all the LFS on biology were in northern Europe. In Norway there are two, concentrating on aquaculture and field experiments (mesocosms), but the “facilities” which attract European scientists are the deep fjords and unpolluted waters. In this sense the Panel believes that the Azores have even more impressive natural conditions, with nearness to the deep ocean (hydrothermal vents, deep-sea living and non-living resources, etc.) and unpolluted waters (not to mention the general uniqueness of the Azores islands). If the expansion of the facilities at Horta, of the Azores University, would include space and some equipment for hosting European scientists and, thus, constitute the basis for a future “*international centre*”. We think that such a facility would be a good candidate for funding under the Large-Scale Facility scheme of the European Commission.

6. Research /Teaching/Administration

The major responsibilities of scientific personnel are research and teaching, but in addition there is a need to involve scientists in management of the institution. There is an increasing tendency, however, by force of circumstances, for scientists to become more involved in basic routine bureaucratic activities, which would be much more cost efficiently performed

by experience administrative staff. During the Panel's visits to the marine science institutions it was noticed that this seems to be a problem in Portugal (as everywhere else). Improvement in this area could be achieved if there was a simplification of administrative procedures and experienced administrative staff were made available to assist scientists and researchers in their required role of management including those associated with the implementation of large scale projects.

7. Data management

Oceanography is an expensive science. Every data point is an investment in shiptime, laboratory analyses, equipment and specialised personnel, and data should therefore be considered national "treasures". The Panel noticed varying levels of data management among the institutions, but it was our general impression that this aspect of oceanography could and should be significantly improved. Expertise should be called upon to develop a *marine data policy*, with clear definitions of responsibilities to manage oceanographic data and make them accessible for Portugal's marine science community and other users. Consideration should be given to the structuring of a *national data management system* – not a centralised one, but an organised network - that would encourage that individual data collections are made available for collective use.

8. Information/documentation

Marine scientists in Portugal are encouraged to publish the results of their research, preferably in international peer reviewed journals. Apart from some exceptions, the number of papers published by the scientists in the units evaluated in "refereed international journals" is still low both in relative (*per capita*) and absolute terms, while the number of "communications" is generally high. One should however note that the mandates of institutions are different and some have responsibilities for applied science and/or monitoring. Clearly, such results must be published in a format that the sponsors of the research consider appropriate and often within very narrow time limits that peer reviewed journals cannot meet. The important matter is that in the general framework of international science publication tradition, each institution has an *information/documentation policy* responsive to its mandate, and that the scientists be encouraged and stimulated to produce good science and optimise their results by an appropriate choice of dissemination mechanisms.

9. Internationalisation

Co-operation with scientists from foreign countries was as a rule well developed (particularly via the programmes of the European Commission) at institutions visited by the evaluation team. However, besides moderate involvement in co-operative programs in the framework of IOC, there seemed to be limited participation, at this time, of Portuguese scientists in World Climate Research Programme (WCRP) and some other large-scale international research programmes such as the International Geo-Biosphere Programme (IGBP). The Panel considers that much of the Portuguese coastal science could contribute to international programmes (e.g. LOICZ) or European programmes (e.g. ELOISE). The *large-scale international research programmes* are engaged in highly relevant topics at the frontiers of marine science. Participation of Portuguese scientists in related workshops,

expert panels, etc. would be an investment in the country's marine science development, apart from the intrinsic value of those events.

10. Co-operation with developing countries

The Panel noticed that many of the marine science institutions in Portugal were engaged, at different levels, in *co-operation with African Portuguese speaking countries*. However, the strong enthusiasm may not necessarily be the most cost-effective way of assisting capacity building in developing countries. University to university co-operation among a limited number of institutions under a real spirit of solidarity should be encouraged, with commensurate support from national funding sources.

2.4 AGRICULTURAL SCIENCES / CIÊNCIAS AGRÁRIAS

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The panel reviewed 13 research centres located in 5 universities scattered around Portugal. Centre evaluation was based on written reports, on-site visits, and informal discussion with research teams. However, the panel recommends that for a more detailed reviewing of activity deeper evaluations of centres at five-year intervals will be required.

The research structure of all centres visited overlapped with the departmental structure of the university. Several centres resembled a federation of various research teams without an underlying theme. There was some need for clarification between the leadership and scope of the research centres and the university departments. The best centres were those, which were able to enlarge and sustain a critical mass on a specialised research subject, but unfortunately there was a general tendency for dispersed, research topics. Even in the very small centres research activity was fragmented among too many different subject matters. Higher internal co-operation towards research cohesiveness can be encouraged by supporting integrated projects with long term objectives.

The financial situation of the centres was good and the availability of funding is not a limiting factor for sustaining a regular research activity. The Panel observed many dedicated research staff. The quality of the facilities varied greatly between centres, from the good or excellent in Faro, Évora and the new Vet School in Lisbon to poor in ISA-Lisbon. The Panel detected cases of under-used and duplicated equipment. Library facilities were rather poor and researchers have limited access to scientific information but this may be self-correcting with greater emphasis on the Internet as a source of technical and scientific information.

The low standard of scientific publications was a major weakness detected overall. Most articles are published in journals of limited circulation or impact. The centres perform better publishing research of specific local importance. The involvement of centres on technology transfer was quite variable but including good examples of technology transfer through the organisation of technical meetings, workshops and courses. Very little research was done in co-operation with private companies.

The Panel identified strong scientific areas of research that are potential areas of excellence such as water management and irrigation, molecular biology and genetics, science and technology of forest products, inventory and modelling, remote sensing, cytogenetics, plant physiology, Mediterranean agricultural systems, brassica crops, and rural economy and sociology. On the contrary some areas that are strategic or specially relevant to Portugal do not receive the research attention or integration proportional to their importance, such as cork oak, food safety and quality including post-harvest technology, environmental impact research including sustainable agriculture, ornamental horticulture, animal science research, genetic improvement of forest trees and horticultural crops, urban and suburban agriculture / horticulture, and tropical agriculture.

Portugal has made a tremendous development of its scientific staff, infrastructures and equipment in agriculture and animal science research. It is now time to concentrate this capital on fewer areas, emphasising Portugal's uniqueness and strength. The overall improvement of research quality will benefit from a more frequent use of economic analysis to develop research projects, a better networking of the various areas of research within the country, concentrating efforts on fewer areas of research, and finally a better integration between the university centres and research carried out by the Ministry of Agriculture.

1. Evaluation Methods and Scope

1.1 Methods

Centre evaluations were based on written reports, on-site visits, and informal discussions with research teams. The on-site visits were the most valuable part of the evaluation and direct contact with the researchers clarified information loosely presented in the reports. The introductory oral presentations were helpful for introducing personnel and reviewing centre activities.

The standard duration of the visits (3 hours) was too short. Although larger centres had longer visits, they still were too brief for a detailed evaluation of activities. The Panel recommends longer and deeper evaluations at five years intervals. Furthermore, the evaluation process should be organised well in advance to be effective.

There was high heterogeneity in report organisation, and many centres did not correctly follow the guidelines issued by FCT. A system should be established to assure that all reports follow a uniform organisation. For example, a common flaw in the reports was the misclassification of the publications with frequent confusion between national and international, and peer and non-peer reviewed journals. Panel members spent an inordinate amount of time reclassifying publications in order to evaluate centres uniformly.

The core of the reports should consist of the activities of each research group or line within a centre, and include the names of researchers, publications, projects, funding, results, and plans for the future. In many reports the publications, projects, and funding were not directly related to the various research groups.

Detailed individual CVs are not needed and should be limited to a single page or organised in tabular form. The main scientific achievements should be limited to the evaluation period and presented in a concise way. They were absent in a majority of reports. Funding information was detailed but emphasis should be placed on money spent per research subject or research line restricted to the evaluation period. Some scientists and scientific co-ordinators were unclear on annual funding levels.

1.2. Scope

The panel evaluated 13 out of the 16 research centres under the umbrella of FCT. Three FCT centres evaluated in 1998 and state laboratories such as INIA and IICT were not covered by this panel. In addition, the Panel had no access to projects that were not financed by FCT such as, INIA and the Regional Directions of the Ministry of Agriculture. However, the information collected from the centres visited and from the projects involving centres and non-FCT financed institutions covers a large share of R&D in agriculture and animal science in Portugal. The present analysis of the state of agriculture research in Portugal is based on a combination of information received from the review, personal knowledge of some panel members, and on informal contacts maintained during the evaluation process.

During the period under evaluation most of research in agricultural sciences in Portugal was financed by PRAXIS and PAMAF programs. Research projects under these two programs did include research teams from more than one institution. Thus, PRAXIS and PAMAF projects provided information about research being done in institutions not being evaluated. This was helpful for a better characterisation of agricultural (plant and animal) research in Portugal.

2. Structure of Research

The research structure of all centres visited overlapped with the departmental structure of the university. In several instances, centres resembled a federation of various research teams within one or between several university departments without an underlying theme. The Panel felt often there was a need for clarification between the leadership and scope of the research centre and the university department. Since most of university departments are organised for teaching purposes, either by disciplines or by commodities, cross-discipline or cross-commodity co-operation had not been formerly encouraged within each department. The most negative influence of teaching structures on research was the lack of co-ordination of projects and research teams from different teaching departments.

ICAM-Évora has overcome the departmental structure limitations by establishing a completely new and independent structure for research. The centre is organised by major integrated research areas combining crops and disciplines. Research areas are different from teaching courses and research co-ordination is independent from department leadership. The Panel considers this is a good example to be followed.

Centre size is highly variable among centres ranging from UTAD-Vila Real, with a single large centre including all university departments related to agricultural and animal sciences, to ISA-Lisbon with 10 small to medium centres, each one corresponding to a single department within the College of Agriculture and Forestry. Small centres have higher potential for excellence if they are specialised in a single subject. Unfortunately the tendency for dispersed research topics was omnipresent regardless of the size of the centres. Even in the very small centres research activity was fragmented among too many different subject matters.

The PRAXIS-Program policy for research projects with obligatory partnership outside the home institution has also favoured the isolation of research teams within a centre. In many instances there was co-operative research with teams located a few hundreds kilometres away while ignoring the research group next door or across the street. This policy has resulted in good co-operation between teams from different institutions within Portugal e.g. CBAA and CDCTPV (plant physiology), CDCTPV and SPAA (molecular markers), ICAM and CEP (soil sciences), ICETA-UTAD and ICAM (animal nutrition), ICAM and IISA-Vet-Lisbon and ICAM (animal diseases), but sometimes at the expenses of enlarging the critical mass within each institution and promoting inter-departmental co-operation.

Almost all researchers in the centres were university faculty members with variable teaching load and other non-research duties. Very few centres had other staff members at the Ph.D. or post-doctoral level involved full time in research. However it was evident that faculty members in the best centres devoted more time to research and research groups were better structured.

In university research centres, but not in state laboratories, research policy is not imposed from the top down. In the universities the “freedom” ethos associated with teaching also applies to research, resulting in very diversified teams and topics. The interaction between

research and teaching and the need to train post-graduate students makes research quite innovative in certain areas and easily adapted to new currents and trends. As a consequence, research in universities may increase in originality but decrease in depth and breadth. Similarly, research in non-university setting where support is continuous may become detailed, if not ponderous, but often lacks the originality associated with young, ambitious students. Clearly successful research in agriculture may benefit from a combination of both university and non-university approaches.

The best teams were those that which through strong and visionary leadership were able to enlarge and sustain a critical mass on a specialised research subject e.g. irrigation, wood technology, cytogenetics. This trend has been encouraged by multiyear financing from FCT ("Financiamento Plurianual") and perhaps by the evaluation process itself. Some centres have made an effort towards higher internal co-operation by presenting centre projects. This trend towards research cohesiveness can be further encouraged by providing support to those projects that demonstrate and articulate research activities with long term objectives.

3. Resource Utilisation

3.1. Financing

The panel was impressed by the financial situation of the centres and considers that the availability of funding is not a limiting factor for sustaining a regular research activity. However, the estimation of funding level in the different sub-areas is complex because funding derives from various research teams and often involves several institutions. As a result of recent PRAXIS and PAMAF programs there appears to be an adequate level of national funded projects. European projects were much less important. Multi-year funding from FCT ("Financiamento Plurianual") was relatively small. Non-governmental money was of little importance particularly industry-funded research projects. Several centres received direct financing from the industry for services but very little for conducting research. Industry support for university research funding tends to be low in Europe as compared to the United States.

Continuity of research support is particularly important in agriculture and forestry. Even with 3-4 year projects it is difficult to maintain long-term research lines in agriculture. This is specially important with forestry trees, ecosystems, and breeding, where there is a need for keeping experiments running for extended periods of time. This problem needs to be addressed.

3.2. Personnel

The Panel was impressed by the high number of master and Ph.D. students in most of the centres. There was a general trend to increase the number of young people involved in research. In universities such as Évora and UTAD, where faculty number is still expanding, many Ph.D. students are teaching assistants with a contract with the university. At ISA where faculty number has stabilised, most post-graduate students are supported by PRAXIS grants or by other institutions, e.g. INIA, polytechnic schools of agriculture.

In general the Panel observed an enthusiastic and dedicated research staff. In most cases staff members were enjoying their work and showed a tremendous potential for producing good research. There were no detailed figures about assistant and technical staff in the various centres but only few researchers complained about the need for more technical staff. The laboratories seemed to be well staffed with personnel. However many technicians are paid by projects through short time contracts and have low technical qualifications. Very few of them have university degrees. The use of high-tech and complex research equipment requires long-term, well qualified personnel which was only available in some research units.

There were large differences in staff age between centres owing to university policy regulating the number of undergraduate students. Those centres located in universities that had a stable number of students during the last decade have older research staff due to legal restrictions in hiring new faculty members. In contrast, centres in universities such as Évora, UTAD and Faro, which have increased the number of under-graduate students, could contract new staff. In those centres with restrictions on recruitment of new staff members to replace retirements, the admission of graduate students and post-doctor researchers is a possible way to introduce "new blood" to research teams.

3.3. Facilities

The quality of research facilities varied greatly between centres. In Faro and Évora the facilities were good to excellent, with new buildings and equipment. CIISA (Vet School-Lisbon) has just moved to excellent new facilities. In contrast, most research centre facilities located at ISA-Lisbon were poor. Laboratories were ancient, research teams were dispersed in different buildings or parts of buildings, and in general there were consistent lack of space to install equipment and to work properly and safely. In many cases the lack of adequate facilities was a major constraint restraint for research. Some of the infrastructures and equipment purchased with "CIÊNCIA" funds are becoming obsolete. The panel saw no clear policy in most of the centres for replacing and upgrading old equipment.

The panel detected cases of under-used and duplicated equipment. There were very few examples of equipment shared by various research teams. ICAM-Évora, where the same laboratory can be used by different research units, was the exception. This model should be encouraged.

Library facilities are rather poor and researchers have a limited access to scientific information. This may contribute to the tendency of repeating research already done and ignoring new trends in agriculture research. The centres should use some funding for the installation and usage of international databases to become better acquainted with international research before initiating and designing projects.

4. Character and Quality of the Research

4.1 Research Profile

The low standard of scientific publications was the major weakness detected overall. The centres have published a high number of articles but mostly in journals of limited circulation or impact. Many centre researchers contributed to international conference proceedings, yet many of these presentations were not formally published. The number of articles in peer-reviewed journals of international stature remains low although with the majority of international publications resulting from a few prominent researchers. The low contribution to international journals contributes to the limited impact of Portuguese agricultural research on international science. The centres perform better publishing research of specific local importance.

There are good examples of technology transfer through the organisation of technical meetings, workshops and courses. PAMAF projects have an intense interaction with the users and were a good example of conducting R&D to meet specific needs. The involvement of the centres on technology transfer/extension was quite variable. With the exception of the CBAA-ISA Panel members lacked information about the extension policy of the country, in general, and the Ministries in charge of Agriculture and Education, in particular. In Vila Real the Panel heard that extension was not among missions of the ICETA-UTAD (although extension was clearly among scopes of certain research teams) but in Lisbon, Évora or Terceira the Panel understood that scientists felt it was their job to transmit results to practitioners. At CDCTPV-Faro and the animal science centres there was less concern about making information available to the users.

Very little research was done in co-operation with private companies. There were a few projects that included private companies but very few company-founded projects. Exceptions are forestry projects funded by pulp companies. The low number of large companies in the Portuguese agri-food business may partially explain this situation. However, the majority of the centres were not prepared for contractual research with leading agri-food companies. The only centres with patents were EBAA-ISA, which has a spin-off project for technology transfer in the field of applied microbiology, and CDCTPV-Faro

It should be noted that the centre evaluation criteria emphasising scientific publications and patents underestimates the impact of research on animal and agriculture production systems. Some research in this area is unfashionable with few international publication outlets and advances are unsuitable for patenting. In ICAM-Évora, some research teams state clearly that the objective of their research was to solve important problems in agriculture rather than contributing elegant, journal papers. However, the Panel was not convinced that there was a conflict of interest in these two goals.

In many instances researchers did not consider the economic consequences of their research. This was specially important in the more applied fields, where the potential impact of the results on the agricultural and animal producing systems needs to be

evaluated. The Panel felt a need to incorporate economic component in research specially in areas with requiring a cost-benefit analysis such as eradicating animal diseases and dry land farming.

The Panel considered that research activities at most centres was too diversified (with some exceptions such as water management at CEER-ISA), and noted an unwillingness of centres to concentrate a critical mass in fewer areas of excellence. Research was too fragmented with frequent duplication with other national research teams. In many instances research was too much project dependent and lacked breadth and depth. The dispersion of energy in the majority of research areas makes difficult to achieve a visible international impact. Some research approaches common to many centres such as modelling have been chosen without critical realisation that it is only a tool that has only rare direct application. Furthermore the modelling paradigm was too dispersed in small units with little emphasis on integration and on developing applications.

4.2. Strong Areas of Research

The panel identified several strong scientific areas of research that combined good leadership, innovative work and consistent results. These are potential areas of excellence.

- Water Management and Irrigation at CEER-ISA combines the applicability to Portuguese conditions with a high level of internationalisation. Water is a scarce resource of strategic importance for Mediterranean agriculture, specially for high value-added products.

- Molecular Biology and Genetics is well covered by research groups at CEBAAs and SPAA at ISA, CDCTPV-Faro, ICETA-UTAD and CITA-Azores. Portugal clearly has established national competence in this strategic area although it is fragmented. The annual meetings on plant biotechnology promoted by IBET contrabass to networking between research teams.

-Other areas include Science and Technology of Forest Products, Inventory and Modelling, and Remote Sensing at CEF-ISA; Cytogenetics at CEBAAs-ISA and ICETA-UTAD; Plant Physiology at CEBAAs-ISA, CEF-ISA, and CDCTPV-Faro; Mediterranean Agricultural Systems at ICAM-Évora; Brassica Crops at SPAA-ISA, ICETA-UTAD, and CDCTPV-Faro; and Rural Economy and Sociology at CEESR-ISA with reference to EC interaction.

4.3- Weak Areas of Research

Portugal cannot equally cover all relevant agriculture research areas. Some research areas have to be put aside in order to concentrate efforts for the most important and relevant ones. The following areas are strategic or specially relevant to Portugal but do not receive the research attention or integration proportional to their strategic importance.

- Cork Oak deserves high attention by teams working on ecophysiology, plant pathology, micropropagation, breeding, and cork quality. Despite the expertise and excellent work dedicated to cork oak at CEF-ISA, CDCTPV-Faro, and ICAM-Évora, there is a lack of

integrated approach and co-operation between research teams. The establishment of co-ordination of cork oak research will be important for developing the present work into an area of excellence.

- Food Safety and Quality is a major research theme that was almost ignored by the centres. Some exceptions were the work on brassicas at UTAD, cheese at CEBA-ISA and wine and traditional produces at ICAM. No work exists on nutraceuticals, food quality improvement, or post-harvest of fruits and vegetables.

- Environmental Impact Research, which includes investigations concerned with preventing adverse environmental consequences of agriculture and animal production as well as landscape protection, is below expectations. Portugal has beautiful unique rural areas such as the Alentejo and Azores that must be preserved by sustainable agriculture practices. Research is needed on economic sustainable agricultural systems to defend the rural areas from over use or abandonment. Non-agricultural activities using the rural space were almost forgotten. Irrigation studies were concentrated on crops and neglected leisure areas such as golf courses and gardens. There was little research on ornamental horticulture and landscaping.

- Animal Science Research is not at the same standard as research on Crop Science. Animal Nutrition at SPAA-ISA and ICETA-UTAD was not innovative. Research at veterinary schools needs a better connection with production systems. No research is carried out at veterinary clinics.

- Genetic Improvement is underinvestigated. There are no national programs on long term genetic improving of products vital to Portugal such as vine, forest trees or horticultural crops. The grain breeding programs which were world famous in Portugal are in decline. Tools of crop improvement are often presented as goals, e.g. hybridisation in grain species, variety characterisation in vine and olive, and in vitro propagation in cork oak.

- Urban and Suburban Agriculture/Horticulture is underinvestigated. This field of research is receiving increased international attention, particularly for developing countries. Portugal could become a major player in this field owing to its historical knowledge and understanding.

- Tropical Animal and Agriculture Research lacks a coherent strategy and results are substandard. There is insufficient perception of the common goal of tropical and subtropical research in a temperate country. The exception is the strong potential for socioeconomy in tropical and subtropical environments at CICAT-ISA.

5. Recommendations

1. In recent years Portugal has made a tremendous development of its scientific staff, infrastructures and equipment. It is now self sufficient in training scientists. Many scientific and applied results have been published. However Portugal has been less successful in channelling its resources to concentrate on those efforts that are important and worthwhile from both a scientific and technical point of view. It is now time to concentrate

this scientific capital on a limited number of areas which will give the country strength where many other European countries are weak. These include Mediterranean agriculture, the unique situation of the Azores, regional high quality products (wine, local swine races, certain fruits, and cork oak).

2. Institutions must utilise an economical analysis to develop research projects and to evaluate the results for field applicability. Economic analysis should become part of project designs. There is a need for strategic planning with the approach developed in the Centre of Economy and Sociology at ISA.

3. Areas of research that are strategic for Portugal should be better networked within the country. The best example is cork oak where there is a need to establish a national research co-operative to co-ordinate the various teams working in this field and avoid overlapping of subject matters. This interactive structure needs to be financed by FCT.

4. Centres need to reduce the number of research topics and to concentrate the efforts on fewer areas of research to encourage synergy between teams. The stronger internal groups could then improve co-operative research with foreign institutions.

5. Although the Panel reviewed research centres at Universities it is aware that there is a significant lack of integration with projects and research carried out by the Ministry of Agriculture. Research at the Ministry of Agriculture is a black hole that must be turned around to interact with University Research.

3. Health Sciences / Ciências da Saúde

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Introduction

From October 4, 1999 through October 16, 1999, thirty-four scientists from the United States and Europe visited health sciences research institutes in Portugal supported by the Foundation of Science and Technology. This visit was requested by the Ministry of Science and Technology of Portugal and was coordinated by that Ministry. The list of scientists involved in the visit is enclosed separately. In addition, the review of one research unit, the Gulbenkian Institute for Genetics and Development of Natural Tolerance, could not occur during this period; therefore, this institute was visited on November 22, 1999 by three scientists from the United States.

I should first say that all the visitors and I are extremely grateful for the welcome and assistance provided by the staff of the Foundation of Science and Technology. We especially would like to emphasize the kindness expressed to us by Dr. Maria José Camecelha de Abreu Coordinator of the Evaluation of Research Units - 1999, who was the indefatigable organizer of the visit; and Professor Manuel Heitor, Coordinator of the Programs of Support to the Scientific Institutes, who met with us several times; and, finally, Professor Luis Magalhaes, President of the Foundation of Science and Technology, who took the time from his busy schedule to meet with the visitors twice and provided a lot of information that was very important for all of us.

With respect to the evaluation of the centers, we are limiting ourselves here to general comments, because specific comments have been prepared for each center and have been submitted separately. There is a wide range in quality and scope among those centers. Some have programs that are as good as they exist anywhere in the world; others would not justify their designation as a center of research and are either individual research projects or part of a teaching service where education is the top priority.

We also made recommendations for Special Programmatic Funding, taking into consideration the recommendations of the site visitors, the requests presented, and the funding provided in the previous cycle. However, it should be noted that the site visitors felt that it was difficult to make recommendations on S.P.F. for several reasons. First, many of the centers did not have a list of the equipment requested, whereas others had a list, but without prices. Furthermore, we were not sure of the amount of money available for this funding. For the next cycle, we suggest that every center prepare a clear list with their own priorities, and either the site visitors accept these priorities, or suggest modifications. For the current review, we decided to propose a certain amount of funding for several centers, and we suggest that the respective center director negotiate with the Foundation how he or she wishes to utilize those funds, taking into consideration the requests made. In other words, we believe that the investigators should have some flexibility in using the funds, provided that the goals of the program are taken into consideration.

We will be outlining, therefore, in this report, certain general problems and suggestions based on our conversations with the various Portuguese scientists and among ourselves.

General Impressions

The impression of all the visiting scientists is that Portugal has a good number of very talented investigators who can make a mark in the future of science related to health problems. With a relatively minor investment, by American standards, (something like 800 million Euros), you could put together a system of investigation that would be the envy of any country, even those with a higher GNP than Portugal. The talent, the effort and the commitment are there. At this time, the Portuguese scientists need to obtain not only the resources necessary, but also an organization that will permit them to develop their potential.

There are major structural problems in the present academic organization. Since we have spent all our careers in universities, (in the case of the Chair, as dean for the last ten years), we would be the last persons to speak against university autonomy, but saying this, we hope that the leaders of the Portuguese universities understand that there are only two alternatives. One is to have a system that encourages, fosters and compensates research, which would be a significant departure from what exists at the moment. This is particularly evident for clinical scientists in the medical schools, where research, at times, is discouraged rather than encouraged. The second possibility, which we personally don't favor, would be to put all the investigators in research institutes with only minor connections with the universities. This system exists in certain countries, but we believe that in a country of the size and development of Portugal, you would be better served by having a university-based research initiative. We will develop this theme further, later in our report.

Another subject that we will talk about further, but of significant importance, is the need for core facilities. Some institutes in Portugal are sending materials to other countries for analysis because of the lack of appropriate equipment, but this doesn't seem to be satisfactory in many cases, because there is some loss of control over what is sometimes an important part of a project, and it may prevent the opportunity to develop certain techniques in the Portuguese laboratories.

We got a clear impression that the existence of the Ministry of Science and Technology, in itself, is a clear indication how serious the Portuguese government is in developing science in the country. Furthermore, the personal involvement of the Minister, Dr. Mariano Gago, reassures us of the importance of this program among the various initiatives going on in Portugal. The impression many of us had at that time was that the Ministry may not be adequately funded, and in several conversations among the site visitors, we felt that a significant investment in this Ministry could do miracles for the development of science for Portugal.

Another problem in the organization is that, the Foundation of Science and Technology has similarities to what we call in the United States the National Science Foundation; but our Foundation provides very few funds for health investigation. The latter is mainly done by the National Institutes of Health. Perhaps the Foundation could be divided into two sections -- that is, one dealing with health investigation and another with all the rest. By having a branch focusing in health, we may elicit more support from political and economic forces in Portugal, which certainly have great interest in health issues of the population.

But another advantage of this division is that it will permit a more direct relationship with other Ministries that have a major role in health; i.e., the Ministry of Education for its role in health sciences schools, and the Ministry of Health because of its authority over hospitals. This is just a suggestion that several of us will be glad to discuss further with you at a future date.

Overall Organization of Research

As we indicated previously, it is an excellent idea to have a Ministry of Science and Technology. The Foundation at this moment does not have adequate funds, and clearly, a major commitment from the government or from private enterprise, if possible in Portugal, should be made to increase significantly the funds available for the Foundation. As indicated earlier, the possibility of separating the portion of the Foundation dealing with support of research in health should be considered.

In addition, it is of major importance that funds be set aside by the Ministry for the infrastructure of each of the institutes. This includes renovation and maintenance of buildings, and repairs of equipment. In the United States, we put between 5% to 10% of the total budget aside for renovations and repairs, including equipment. We, in addition, budget at least 10 to 12 dollars per square foot for operation and maintenance of buildings. These are extremely important components of the budget of any research enterprise that are frequently forgotten.

The system of grant application should be changed to create one in which there is a clear understanding of the deadlines for application. Ideally, there should be deadlines for applications once or twice a year, with a clearly established date when the reviews will take place and the decisions made. These dates should be the same every year. If it is not possible to have more than one cycle, the scientists should know that the deadline is, for example, on May 1, with the decision being made available by September 1. In this way, they can prepare their schedules and their budgets appropriately. The funds would be provided to the institutions to be used by the investigators, ideally, for a period of at least three years, with yearly reports. At the end of the three years, they could apply for renewal. The research funds should be clearly restricted towards the goals of the project, and major changes in the budget would have to be approved by the Foundation. However, one should not take away the flexibility of the principal investigator in the use of some part of the funds awarded, provided that they are used towards the goal for which they were given.

There were two other problems perceived by the site visitors. The first is that funds frequently are given separately for fellowships and for research. Therefore, a person may obtain a fellowship and not have money to do research. Secondly, there is an insufficient amount of thematic research involving multiple investigators, similar to program projects in the United States.

Finally, we were not clear if the possibility exists for an investigator to apply for a grant that would include not only funds for equipment, supplies, and technical help, but also for salaries for himself and his collaborators. We are also suggesting that grants should include funds for indirect costs to pay for laboratory space, including maintenance and renovations.

Medical Schools and the Research Enterprise

The site visitors fully understand and support the autonomy of universities; however, we also expect the leadership of the universities to emphasize the importance of research. We, in many cases, had the impression that research was not supported by the chairs of the various departments of the medical schools. For this, it is essential that the progression in the academic ranks be in large part dependent on the research productivity of the individual faculty member. Also, the chairs of the departments should lead by example by providing mentorship to their younger faculty members and by being involved in research themselves.

At this moment, there doesn't appear to be a system of review of the activity of the university professors. This also is a controversial subject in the United States for those with tenure; however, we would advise strongly to have a system of review every five years, but for this to be successful, it would have to be a constructive review, rather than a punitive one. In the United States, a full professor has tenure, but a chair does not, being appointed for a period of time, usually five years, followed by a review by outside and inside professors. In other words, a tenured full professor may or may not have a chair (catedra), and therefore, may or may not run a department or service.

This brings us to another problem, which is that, at this moment, practically all the physicians on the faculty of the medical schools of Portugal are, in fact, part time. Due to the complexity of biological research at the present, it is nearly impossible for academic physicians, who are not full time, to have enough time to teach, supervise clinical work when appropriate, and do internationally competitive research. Therefore, the question of full time faculty needs to be addressed if the universities are going to be the major centers of research. Otherwise, you will finish by having a system where research will be done, essentially, in research institutes either non-affiliated with, or only marginally affiliated with, universities. We don't think, in a country the size of Portugal, this is the direction that should be taken, and we hope that the leaders of the various universities have the vision and power to develop the research enterprise within the walls of the university.

In addition, in order to develop clinical investigation, it is essential to create interest in research early in the careers of physicians. For that purpose, either the medical students should be involved in one or more research projects during the six years of their studies, or they should be given a period of six months to a year where they work full time in a research laboratory. In some cases, it should be possible for students to take a more prolonged period in order to obtain another degree besides the M.D. This occurs sometimes in the United States, and is very helpful towards creating future academic physicians who are high calibre researchers and teachers. These options may not be applicable to all students, but we believe that they should be available to all.

It seems that there is too much didactic teaching of the medical students, with too many lectures given to large groups. This is a subject that the Chair personally has been made aware of in other visits to the medical schools in Portugal, and has been confirmed by the other site visitors in this visit. More emphasis in small group discussions and laboratory work would be helpful in the sense of exciting the curiosity of the medical students toward science, and also may permit some of the teachers to spend more time in research.

Stays in other laboratories either within Portugal, in Europe, or overseas should be encouraged for young investigators, but some mechanism needs to be arranged to guarantee that they will have a position and a laboratory when they come back; otherwise, many of them are not going to return. They should be able to pursue the investigation they started abroad when they return to Portugal, or time and money spent when abroad may be lost.

Facilities and Technical Help

There is a great need for core facilities for expensive equipment. There is an acute need for both modern molecular biological, as well as biophysical, instrumentation. No single research laboratory can afford to purchase such equipment, and clearly there is equipment that cannot be justified having in every center, or even in the three major cities of Portugal. Therefore, core laboratories are essential. The Ministry of Science and Technology, with the cooperation of the universities and the advice of outside scientists should decide on the establishment of such laboratories to be used by any qualified scientist. Another possibility would be to request applications, perhaps every two years, from groups of researchers for shared instrumentation. Portugal is not so big that this would make research cumbersome, and not all types of equipment should be part of those core laboratories. However, in addition to resources for very expensive equipment to be used by various centers, the centers themselves lack core equipment to be used by several scientists in that center. This issue should be addressed, possibly by providing funds especially for that purpose.

Another point -- there isn't enough interaction between the various centers and various laboratories. For instance, there was a possible theme of dermatological research that appeared in several centers that might benefit from being gathered together in a cohesive unit that could have a significant impact in this area of research. Sometimes centers in Portugal have more communication with laboratories abroad than between themselves. Although we strongly recommend not only the continuation, but also an increase in the number, of scientists going abroad, we believe that Portuguese scientists should also take advantage of the talent that exists at this moment in their country. With this in mind, the Foundation should develop a catalogue of expertise for the various research units, which may then serve as a resource for encouraging collaboration, and could also be helpful in the planning of national core facilities. Furthermore, the Foundation could gather all the units' directors for a meeting at least once a year to promote and support sharing of techniques and ideas for projects.

Another frequent finding is that there are no trained technicians in the majority of the laboratories, and the technical work is carried out either by the scientists themselves or by Ph.D. students. Although there is something to be said about scientists being familiar with techniques, what we saw is excessive, and the scientists – instead of spending time planning their research, supervising technical help, reviewing data, and preparing manuscripts, are spending their time doing work for which they are over-qualified. Therefore, some thought needs to be given to having a system of training technicians, perhaps in secondary schools or even universities; and providing funds in the grants to hire technicians.

Information

We are aware that the Ministry of Science and Technology has given priority to information systems, but this is an area that still needs major development and major commitment of funds. It seems that it is necessary to upgrade the cadre of individuals with credentials and interest in computational health and computational biology. Probably as a first step, a study should be made of the needs in information systems specifically related to medical and biological research. Then a plan should be established for integration, nationwide, of information systems to serve the health research community. However, information systems are not used only for research. They are essential for hospital activities, financial assessments, and teaching; and, therefore, collaboration on this subject between various Ministries is essential.

We also think that Portugal needs to have one or more scientific research libraries. Again, this should be a core facility, rather than every institute having their own small library. With the development of information systems, one could conceive of having just one major research library serving all the scientists in Portugal, which could be called the National Library of Medical Sciences.

Job Market for Trained Scientists

In our conversations with Professors Gago and Magalhaes, we received the impression that there is a major effort taking place in Portugal to have jobs for post-doctoral scientists and for scientists who have Ph.D.'s. We would like to point out that the scientists themselves don't perceive the situation the same way, and feel it is very difficult for post-docs to obtain jobs and the possibility of a career, especially in Universities. Besides championing the creation of research positions in universities, maybe the Ministry of Science and Technology could work with industry in Portugal and abroad towards developing a system of placement for post-graduates. Also, it would be very helpful to disseminate the availability of positions through the Internet, or by any other method easily available to scientists looking for jobs.

Another concern touched upon previously is that physicians who are investigators need to spend the majority of their time doing clinical work in order to take care of their families, and therefore, they cannot be competitive in the research arena. In this way, in the future you may not have physician-scientists who are internationally competitive. Consideration should be given to career development awards to stimulate young physicians to a career in research. In the United States, there is, for instance, the KO8 type of award from NIH that could probably be adapted to Portugal. We can provide information on the types of funding that exist in the United States specifically for this purpose.

In any case, post-doctoral support should be provided for a period of three to five years, during which time, they should not be doing teaching or clinical work. Furthermore, for faculty members, it would be very helpful if there is a mechanism of sabbaticals available, every six years. During a sabbatical, which would have to be approved by the university, the faculty member could spend time in a laboratory, either in Portugal or abroad, working exclusively on research.

We want to stress that these problems impact not only on the development of research, but also on the level of medical practice, and therefore, health care for the people of Portugal. High standards for patient care are less likely if the practicing physicians are not able to use the results of medically relevant clinical and basic research. As more physicians gain familiarity with research, medical care will be improved.

Review of Research, Priorities and Planning

A mechanism of periodic peer review of the research is essential. This should be done, again, in a constructive way, and although it may include some scientists from Portugal, we believe that, at least in the initial phase, should be done mainly by scientists from abroad. We know that this already exists in certain centers, but it would have to be done in a more systematic way, with established deadlines and review dates, and with reports sent back to investigators (with constructive criticisms) in a relatively short time. We believe that this is already in the future intentions of the Minister of Science and Technology, but we all felt that these plans should be clearly communicated to the individual investigators.

Also, as seems to be in the plans of the Ministry, a group of scientists, including some from abroad, should make suggestions about the priority areas of research in Portugal. In countries much larger, like the United States, these priorities are established by the major grant-awarding institutions, both public and private. We believe the same could be done for Portugal. We would suggest that a short list of research priorities be established. Those priorities should be based, in large part, on significant health issues facing Portugal. Additional important criteria would include research areas that are unique to Portugal, and areas that already possess a critical mass of excellent scientists. This would not prevent other areas from being investigated, but it would focus the financial support and the interest in the areas chosen.

Besides priorities for the overall research enterprise in Portugal, one needs to have a better notion of the strategic planning for the individual research units. The Foundation should encourage each unit to develop a strategic plan for the upcoming five years, which should include specific goals and objectives. With the presence of such plans, it would be easier to judge the progress of each center. In addition, these strategic plans could help in the establishment of the national priorities as well as help in the establishment of collaboration among several institutes.

Patents and Intellectual Property

This is an area for which a new office should be established, probably at the level of the Ministry of Science and Technology. During our visit, the site visitors found that there were several ideas presented by the Portuguese investigators which, in our opinion, were patentable. Certainly, there are many more that we are not aware of. It seems that there is no easy mechanism for obtaining those patents. We suggest that the Foundation have an industrial advisory board, or also possibly, that each major university have such an advisory board. These boards would function to educate health scientists and prompt them to do invention reporting, trademarking and potential implementation. This is an important subject that should be addressed and that could provide additional funds for research in the various institutes. Obviously, attorneys and businessmen also should be involved in such

advisory groups. Since this is very developed in the United States, we would be glad to provide you with additional information.

Conclusion

All of the site visitors, without exception, were enthusiastic about the possibilities for a glorious future in research in the health sciences in Portugal. There is a tremendous amount of talent and a reasonable level of productivity, considering the difficult conditions. Portugal is fortunate to have a Ministry of Science and Technology with vision and enthusiasm towards making Portugal a major player in the international arena of health sciences research.

We, the members of the site visit team, are willing to provide any advice that the Portuguese scientific leadership believes necessary and appropriate for the development of the health sciences enterprise in Portugal. We are most thankful and honored to have been given this opportunity to review the Portuguese scientific institutions related to the health sciences.

Respectfully submitted for the Site Visit Team,

Ruy V. Lourenço, M.D.

Chair

4. Engineering Sciences and Technologies Ciências da Engenharia e Tecnologias

4.1 CIVIL ENGINEERING / ENGENHARIA CIVIL

Panel Coordinator:

Artur Ravara
GAPRES, Lisboa, P

Manuel Matos Fernandes (Sub-Coordenador/Sub-Coordinator)

Universidade do Porto, Faculdade de Engenharia, P

Evaluation Panel:

E. Plate

Universität Karlsruhe Institut für Hydrologie und Wasserwirtschaft, DE

Enrique J. Calderon

E.T.S.I. Caminos Canales y Puertos, SP

Hugo Hens

Katholieke Universiteit Leuven Department Burgerlijke bouwkunde, B

Paolo Pinto

Università degli Studi di Roma 'La Sapienza' Dipartimento di Ingegneria Strutturale e Geotecnica, IT

1. OBJECTIVO E ÂMBITO DO RELATÓRIO

Durante o ano de 1999 teve lugar a avaliação de 7 unidades de investigação em engenharia civil, sediadas em universidades públicas portuguesas. A avaliação foi conduzida em moldes idênticos aos da avaliação anterior, realizada em 1996, tendo incidido sobre as mesmas unidades.

A avaliação de cada unidade deu origem a um relatório preparado pelo painel de avaliação.

Foi solicitado ao coordenador do painel a preparação de um relatório geral que apresentasse uma visão global do sector avaliado, numa óptica orientada para o futuro, destacando designadamente recomendações quanto aos seguintes aspectos:

- . Qualidade da investigação;
- . Natureza da investigação;
- . Organização da investigação;
- . Financiamento e utilização de recursos.

O presente relatório pretende dar resposta ao solicitado.

2. UNIDADES SUBMETIDAS A AVALIAÇÃO

Foram submetidas à avaliação de 1999 as mesmas 7 unidades que tinham sido objecto da avaliação de 1996, ou seja:

- Centro de Engenharia Civil da Universidade do Minho (CEC-UM)
- Centro de Estudos do Departamento de Engenharia Civil da Universidade do Porto (CEDEC-UP)
- Instituto de tecnologias de Produção na Construção da Universidade de Coimbra (IC-UC)
- Centro de Investigação em Engenharia Civil da Universidade de Coimbra (CIEC-UC)
- Centro de Estudos de Hidrosistemas da Universidade Técnica de Lisboa (CESUR-UTL)
- Centro de Estudos Urbanos e Regionais da Universidade Técnica de Lisboa (CESUR-UTL)
- Instituto de Tecnologias de Produção na Construção da Universidade Técnica de Lisboa (IC-UTL)

3. CONSTITUIÇÃO DO PAINEL DE AVALIAÇÃO

Integraram o painel de avaliação os seguintes avaliadores estrangeiros:

Hugo Hens, Universidade Católica de Louvaine

Erich Plate, Universidade de Karlsruhe

Paolo Pinto, Universidade de Roma

Enrique Calderon, Universidade de Madrid

A coordenação do Painel esteve a cargo de:

Coordenador – Artur Ravara

Coordenador-adjunto – Manuel Matos Fernandes, Universidade do Porto

O Professor Erich Plate e o Eng^o Artur Ravara tinham participado no painel de avaliação de 1996.

4. METODOLOGIA SEGUIDA NA AVALIAÇÃO

A avaliação foi conduzida nos moldes estabelecidos pela Fundação para a Ciência e a Tecnologia, idênticos aos da avaliação de 1996.

Assim, as unidades prepararam relatórios que o Painel de Avaliação apreciou, a que se seguiu uma visita às unidades, que decorreu entre 13 e 17 de Setembro de 1999.

Na sequência das visitas cada avaliador estrangeiro apresentou um relatório sobre cada unidade e o painel preparou um relatório de conjunto sobre cada unidade, os quais foram entregues, respectivamente, em Setembro e em Novembro de 1999.

O presente relatório encerra, nos termos referidos no seu início, a actividade do painel de avaliação.

5. ANÁLISE GLOBAL DA SITUAÇÃO DAS 7 UNIDADES

5.1 Traços comuns da evolução da actividade

Não obstante as 7 unidades de investigação sobre as quais incidiu a avaliação estarem em situações muito diferentes, é possível identificar uma linha comum no seu percurso, na qual se podem identificar basicamente as três fases seguintes:

1ª Fase – aquisição de competências para leccionar

Nesta fase, a prioridade é recrutar docentes qualificados para leccionar as disciplinas curriculares. Sobre esses docentes recai a responsabilidade de desenvolver acções de investigação e de formar equipas de investigação. Como é natural, os temas de investigação correspondem, em regra, aos domínios de doutoramento dos docentes.

Nesta fase a questão crucial é a da “massa crítica” do corpo docente para a própria acção docente.

2ª Fase – expansão da actividade de investigação

Nesta fase, superada a questão da “massa crítica” anteriormente referida, tem normalmente lugar o lançamento de projectos de investigação, incidindo sobre temas ainda muito ligados aos domínios de especialização dos docentes doutorados. Decorre, nesta fase, a constituição de equipas de investigação, em paralelo com a formação pós-graduada. Intensifica-se o contacto das unidades de investigação com o meio exterior, com reflexos muito importantes sobre os domínios de maior interesse para a prestação de serviços por aqueles.

3ª Fase – estruturação das unidades de investigação

Nesta fase, a prioridade incide normalmente sobre a identificação dos domínios prioritários, de investigação, com as correspondentes opções quanto à alocação de meios, bem como à organização das unidades de investigação tendo em vista alcançar os objectivos estratégicos que se propõem.

Implica necessariamente priorizar, dentre as áreas de investigação tratadas na 2ª Fase, aquelas em que a unidade reúne melhores condições para alcançar a excelência. Esta priorização envolve questões delicadas visto que: por um lado tem reflexos de vária ordem sobre a actividade dos investigadores, face à escolha das áreas potencialmente mais promissoras; por outro lado, a hierarquização entre estas áreas e as restantes não pode pôr em causa os domínios de qualificação necessários a leccionar as matérias curriculares, que constituíram o principal objectivo da 1ª Fase.

Compreende-se assim que esta passagem à 3ª Fase seja tanto mais facilitada quanto maior fôr a dimensão e, conseqüentemente, a “massa crítica” da unidade.

Salientam-se, relativamente à caracterização feita, os seguintes aspectos:

- a caracterização das 3 fases é muito esquemática e amplificada, sendo apresentada com o único objectivo de exprimir a percepção do painel de avaliação quanto à situação das unidades avaliadas;
- as fases não são estanques, mas interpenetram-se em maior ou menor grau;
- embora a evolução dos recursos humanos constitua o principal facto de progresso das unidades de investigação ao longo das 3 fases referidas, as condições de trabalho, designadamente no que diz respeito a equipamentos, instalações e formas de financiamento, são condição necessária para potenciar a capacidade dos investigadores.

É, aliás, a falta destas condições que justifica que universidades das mais antigas do País só há relativamente poucos anos tenham disposto de condições que lhes permitissem actividade de investigação sustentada, tal como caracterizado na “2ª fase”.

5.2 – Situação específica de cada unidade

Na linha enunciada, a situação das 7 unidades de investigação avaliadas é a seguinte:

Centro de Engenharia Civil da Universidade do Minho (CEC-UM)

O CEC registou um progresso assinalável ao longo dos últimos 3 anos. Com efeito, em 1996 encontrava-se na transição da 1ª para a 2ª fase e presentemente as suas prioridades orientam-se claramente dentro dos moldes referidos para a 3ª fase.

Centro de Estudos do Departamento de Engenharia Civil da Universidade do Porto (CEDEC-UP)

Aplicam-se ao CEDEC as considerações anteriormente feitas sobre as razões que levam a que em Universidades antigas seja relativamente recente a actividade de investigação sustentada.

Com efeito, é flagrante no CEDEC o constrangimento causado pela falta de instalações adequadas. A mudança para as novas instalações, previstas para o corrente ano de 2000 contribuirá certamente para permitir à unidade estruturar-se, conforme os seus propósitos expressos na avaliação e transitar em plenitude para a 3ª fase, corrigindo as fortes assimetrias que actualmente se verificam nos grupos que a constituem.

Instituto de Tecnologia da Produção na Construção da Universidade de Coimbra (IC-UC)

O IC-UC registou progressos nos últimos 3 anos, estando a procurar transitar da 2ª para a 3ª fase. A evolução foi patente sobretudo na sessão de apresentação da unidade ao painel de avaliação, que reflectiu evolução positiva relativamente ao relatório da unidade, preparado cerca de 6 meses antes.

Foram apresentadas com muita lucidez e objectividade propostas de financiamento para equipamentos específicos, que o painel acolheu favoravelmente.

Também aqui, a mudança para as novas instalações, prevista para 2000, permitirá melhorar consideravelmente as condições de trabalho da unidade, embora os constrangimentos não sejam tão fortes como no caso do CEDEC.

Centro de Investigação em Engenharia Civil da Universidade de Coimbra (CIEC-UC)

A situação é bastante próxima da do IC-UC, com alguma vantagem para o CIEC na medida em que parecem mais amadurecidos os objectivos estratégicos da unidade.

Foi no contacto com esta unidade que se tornou claro, para o painel de avaliação, a necessidade de coordenar acções que permitam um verdadeiro salto qualitativo na qualidade da construção, especialmente de edifícios, em Portugal. Esta questão, referida no relatório de avaliação do IC-UTL, é retomada no parágrafo 6.3 do presente relatório.

Centro de Estudos de Hidrossistemas da Universidade Técnica de Lisboa (CEHIDRO-UTL)

O CEHIDRO está plenamente integrado na referida 3ª fase, dispondo de uma organização sólida, com objectivos estratégicos, bem definidos, desenvolvendo as suas actividades com elevado nível científico e técnico. Embora se verifiquem assimetrias entre os grupos que o constituem, o nível global da unidade é, na opinião do painel de avaliação, muito bom.

Centro de Estudos Urbanos e Regionais da Universidade Técnica de Lisboa (CESUR-UTL)

O CESUR apresenta uma característica que o distingue de todas as outras unidades de investigação avaliadas pelo painel; é constituído por grupos, cada um dos quais reconhecidos nacional e internacionalmente, mas com interesses tão heterogéneos que no seu conjunto não constituem uma unidade de investigação, na acepção literal do termo.

Qualquer dos grupos que integram o CESUR dispõe de uma senioridade incontestável.

Instituto de Tecnologias de Produção na Construção, da Universidade Técnica de Lisboa (IC-UTL)

O IC-UTL está numa situação semelhante à do CEHIDRO, tendo maior dimensão e cobrindo um leque mais largo de temas, de uma forma que levou o painel a considerá-lo a unidade mais pujante das 7 que avaliou. Tal não significa que não existam assimetrias entre os grupos assinalados no relatório sobre a unidade. Mas no seu conjunto o IC-UTL é sem dúvida, no entender do painel de avaliação, uma unidade de muito bom nível, com objectivos estratégicos bem definidos e uma organização que os suporta de forma adequada.

6. AVALIAÇÃO GLOBAL DO SECTOR

Seguidamente sintetiza-se a opinião do painel de avaliação relativamente à qualidade, natureza, organização e financiamento do sector constituído pelas 7 unidades de investigação avaliadas.

6.1 Qualidade da investigação

É incontestavelmente de elevada qualidade a investigação desenvolvida nas 7 unidades avaliadas. É no geral conduzida por investigadores de elevada qualificação, muito motivados, fortemente envolvidos em cooperação nacional e internacional. A produção científica é elevada, verificando-se um sensível acréscimo nos últimos anos de publicações em revistas internacionais.

Dentre os domínios abarcados pelas 7 unidades, que cobrem praticamente todas as áreas da engenharia civil, os que se relacionam com “física das construções”, tecnologias de construção e “fogo” são possivelmente aqueles em que se tornam necessários mais progressos, sobretudo através de esforços concentrados entre os vários grupos envolvidos para que se verifique, a nível nacional, um salto qualitativo nesta área. Com efeito, embora alguns grupos desenvolvam trabalho de elevada qualidade nestas áreas, parece indispensável ao painel dar-lhes mais expressão, de forma a contribuir para melhorar a qualidade da construção, designadamente no que respeita a acabamentos em edifícios, que em Portugal na generalidade deixa muito a desejar, como ficou patente, aliás, na visita feita pelo painel às novas instalações de duas das unidades visitadas.

6.2 Natureza da investigação

Esta questão liga-se com a anterior e também com o problema da dispersão por grande número de temas de investigação apontado pelo painel nos relatórios de várias das unidades. Embora seja incontestável que os temas tratados são bem representativos da temática actual da investigação na engenharia civil, pareceu ao painel igualmente incontestável que os recursos humanos envolvidos são escassos para atingir a excelência na maior parte desses temas. Ou seja, parece aconselhável concentrar mais recursos nos pontos mais fortes de cada unidade. E parece indispensável, como se referiu em 7.1, atribuir maior prioridade a três temas com especial implicação na durabilidade e no conforto da construção, especialmente de edifícios:

- física das construções
- tecnologia da construção
- fogo

A dificuldade que se levanta às unidades para eventualmente seguirem esta orientação é de que não podem abandonar outras áreas de investigação, sob pena de virem a perder qualificação para leccionar com qualidade matérias curriculares.

6.3 Organização da investigação

Nesta matéria, o painel pouco tem a acrescentar ao que consta do relatório sobre cada unidade e à análise apresentada no capítulo 6 do presente relatório.

Afigura-se-lhe, em síntese, que a estrutura das unidades é ou está em vias de ser a adequada, sendo particularmente pertinente a análise que sobre esta questão o CEDEC tem

em curso, pois a sua grande dimensão e heterogeneidade talvez leve a uma estratégia de divisão em unidades menores, à semelhança do que sucedeu no IST (IC, CEHIDRO e CESUR).

Na linha das considerações feitas em 7.1 e 7.2, afigura-se que seria interessante e oportuno analisar a viabilidade de criar dois centros de investigação dedicados a física das construções e a fogo, tirando partido das sinergias existentes nas unidades avaliadas. Julga o painel que essa seria a melhor, se não a única via de se vir a atingir dentro de 5 a 10 anos um nível de excelência nessas áreas, de enorme importância, como atrás referido, para a qualidade da construção de edifícios.

6.4 Financiamento e Respectiva Utilização

Nesta matéria, o painel avaliou a situação apresentada no relatório de cada unidade e pronunciou-se favoravelmente quanto à atribuição de financiamento programático em dois casos.

Globalmente afigurou-se-lhe rigorosa e sensata a gestão de recursos das 7 unidades avaliadas. A tendência de evolução de condições de trabalhos quanto a equipamentos e instalações é positiva e muito sensível no caso das unidades de Coimbra e do CEDEC, que vão dispôr a curto prazo de novas instalações.

A recomendação que o painel apresenta em 7.3 implica recursos consideráveis, para além de forte motivação e espírito de cooperação dos grupos que actualmente exercem a sua actividade nesses domínios.

Artur Ravara

4.2 MECHANICAL ENGINEERING / ENGENHARIA MECÂNICA

Panel Coordinator:

Cristina H. Amon

Carnegie Mellon University - Dept. of Mech. Engng; ICES Institute for Complex Engineered Systems, USA

Evaluation Panel:

Aleksandar Ostrogorsky

University of Alabama Department of Mechanical Engineering CMMR, Huntsville, USA

Andre Preumont

Universite Libre de Bruxelles, Mech.Engng and Robotics Active Structures Lab, B

Bora Mikic

MIT - Department of Mechanical Engineering, Cambridge, USA

Cesar Dopazo

Centro Politecnico Superior, Dept. de Ciencia y Tecnologia de Materiales y Fluidos, Zaragoza, SP

Glenn Sinclair

Carnegie Mellon University, Dept of Mech. Engineering, USA

Thomas R. Kurfess

Georgia Institute of Technology, The George W. Woodruff School of Mech. Engng, USA

This report of the triennial evaluation of the Mechanical Engineering research units of 1999 is based on the analysis of the research reports provided by the research units with the activities performed in 1996-1998 and the plans for 1999-2001 along with the outcomes of the site visits performed in Portugal on September 22 to 29, 1999.

Within the last decade, both the internal and external research environments in Mechanical Engineering in Portugal have changed considerably. Internally, there has been an increasing number of researchers with PhDs who have significant interactions with international research groups either because they have gotten their PhD degrees from foreign universities or/and they have research collaborations with foreign groups. There are also striving PhD programs in some of the Mechanical Engineering departments and research units (e.g., IST, Lisbon) which generate high-caliber researchers performing high-impact technological and scientific research.

The external research environment has also changed in terms of increasing research funds available, ranging from those provided by the Portuguese Science and Technology Foundation and Industry to those sources from the European Community. The overall research funding is still modest by international standards. The government funding is relatively small when compared to that provided in the United States, the Portuguese industrial funding is mostly for technology development with short-term deliverables, and the European funds have been only successfully obtained by a limited number of researchers who have built international collaborations and strong reputation.

It is very encouraging and commendable to see the new generation of PhDs educated in Portugal. However, care must be taken to provide job opportunities and a nurturing environment for these new researchers as well as plenty of opportunities for exposure and interactions with the international research community. This can be achieved in the form of post-doctoral opportunities for recently graduated PhDs, sabbatical leave for junior faculty, and participation on international workshops and conferences. Some degree of isolation has been detected as well as an absence of mobility in the pool of investigators. There is always the risk of self-breeding within a research group and of promotions which would only come from inside. It is also important to continue striving to establish international links and stable collaborations. With the exception of a group at IST, Lisbon, most of the research cooperation is occurring with European researchers. This is clearly convenient because both the geographic vicinity and the opportunities of joint funding from the European Community. However, it is encouraged to broaden the research interactions beyond the European Community whenever there are suitable opportunities.

The opportunities for raising research funds, the infrastructure and resources available, the quality of research, the international reputation, and the leadership and personnel commitment have great disparity across the different units and universities in Portugal. The longest tradition of a research-intensive university culture has been fostered by some research groups of IDMEC at IST, Lisbon and, more recently, by a few groups at Coimbra and Oporto. There is a real opportunity and challenge to promote national cooperation among different universities and research units within Portugal. It is recommended that the Science and Technology Foundation provides the right incentive and reward mechanisms to stimulate and promote national collaboration. In addition, there are opportunities for some units within the same university and across universities to share resources (e.g., high-end computing facilities) and complement faculty expertise.

Regarding what types of research is funded, it is suggested that while single investigator projects should continue to be sponsored, it is also important to place a significant emphasis on multidisciplinary multi-investigator projects that have both “societal relevance” as well as “industrial relevance” for Portugal. Some research units look more as a collection of individual researchers instead of a coherent group with a well-thought strategic plan and research direction. The evaluation panel suggests that for the next cycle of evaluations and preparation of reports, more emphasis be placed on the strategic plan for future activities. This exercise, even though it may be effort and time consuming, can produce excellent benefits on building teams and a coherent research direction and plan. The challenge will be to build a

multidisciplinary environment that emphasizes group oriented research without de-emphasizing the single investigator research model.

Research projects from industry and external sources often times get funded only after preliminary promising results are obtained. Due to the current funding environment it is usually difficult to find external support for a futuristic idea that is in embryonic stage. Therefore, universities with the assistance of the Science and Technology Foundation should develop resources that allow investments in seeding and growing projects and strategic areas. European agencies expect to see *relevance* and also transition of technology to industry. Independent of this observation, it is clear that industry is the driver and “owns” many interesting problems that could lead to high-impact research. Currently most of the technology transfer from Mechanical Engineering research units in Portugal seems to be taking place as specialized services to industry and not as a part of R & D joint ventures. A challenge will be to develop a strategy and an infrastructure, which allows close ties to the Portuguese industry and a balance between fundamental research and applied research relevant to the industrial needs.

4.3 MATERIALS SCIENCES AND ENGINEERING / CIÊNCIAS E ENGENHARIA DOS MATERIAIS

Panel Coordinator:

João Lopes Baptista
Universidade de Aveiro, P

Evaluation Panel:

C. A Lawrence
University of Leeds, UK

José F. Colon
Universidade Politécnica de Catalunya, SP

E. D. Hondros
Imperial College of Science, Technology and Medicine, UK

Hartmut Schneider
Institute for Materials Research German Aerospace Center (DLR), DE

Relva Buchanan
University of Cincinnati Department Materials Science and Engineering , USA

Theo Popma
MESA Research Inst. University of Twente, NL

1. The research Units of the Materials Science and Engineering area were evaluated by the following scientists: Professor Relva Buchanan from the University of Cincinnati, USA, Professor Ernest Hondros from the Imperial College, UK, Professor Theo Popma from the University of Twente, The Netherlands, and Professor Hartmut Schneider from the German Aerospace Center, Germany. This group was coordinated by Professor João Lopes Baptista from the University of Aveiro, Portugal.
2. Eleven research units were evaluated. They were visited by the evaluators during two periods. The first was from 14 to 19 June and the second from 5 to 10 July 1999.

During the first period the visits were to research units in Lisbon (ICEMS-IST; CENIMAT – New University of Lisbon and CITECMAT – University of Lisbon), Coimbra (ICEMS – University of Coimbra) and Covilhã (Materiais Têxteis e Papeleiros and Física e Mecânica dos Materiais – University of Beira Interior).

During the second period the visits were to research units in Porto (CIEP and IMAT – FEUP - University of Porto), Guimarães and Braga (IMAT– Minho and Centro de Ciência e Tecnologia Têxtil – University of Minho) and Aveiro (UIMC – University of Aveiro).

3. The evaluations were done taking into consideration the Reports presented previously by the units, covering the work done during the period 1996-98, and also the reports presented at the visits and the discussions with the evaluators that took place during the visits. The criteria used for the evaluations were derived from the classifications attributed to each of the items in the evaluation forms and from the general impression left on the evaluators from the contacts during the visits. Consideration has been given to comparative aspects between the different units and also to the quality of similar research units in Europe and the U.S.A. The classifications were obtained by general consensus.

Detailed individual reports were issued for each of the evaluated units containing a general appreciation and several suggestions that the evaluators hope can improve the units overall performance in the future. They are annexed to these general comments.

4. We were impressed by the excellence of the program for the visits organised by the staff of the FCT Evaluation Center and also by the technical support during the visits.

We emphasise however that there is still room, before the visits, for some specialised treatment of the data coming from the research units before it is presented to the evaluators. This will facilitate its manipulation, allowing the evaluators to concentrate on the issues for which they have expertise. Account should be taken of the fact that the time available to do the evaluations is rather short. The paper work presented to the evaluators was grossly excessive – this should be confined to briefer reports.

5. We wish also to point out the open mind and good scientific ambience that was found in the units visited, which allowed stimulating discussions and interactions to take place with their members.

There was however one case in which serious differences were found between the data presented in the 1996-98 Report, the ones sent with it for analysis and the ones presented in the Visit Report. This was reported to the FCT authorities by the coordinator.

6. It was found that the research done by several units has a high standard and that they keep their activities at the forefront internationally. Many of their researchers present the results in well-recognised international conferences and publish them in good scientific refereed journals. The organisation of international meetings, the visits by renowned foreign scientists and the mentoring of Ph.D. and M.Sc. students and post-doctoral positions available, some of them also foreign, are helping to the international recognition of these units. Within a classification of 1 to 5 (5 being the best) the panel classified three of the units as 5, four as 4, two as 3, one as 2 and one as 1.
7. Since the previous evaluation had the same coordinator it is possible to compare its results with this one and state that the increase in the output of good publications and post-graduation degrees within the area of Materials Science and Engineering is remarkable. Published statistics also verified this. Such can be certainly attributed to a steady financing policy (a novelty in Portuguese research) that during the last years has allowed the research units with capability to do so to have, at least, medium term programs.

8. The patent output, although having increased when compared to the previous evaluation period, is still very modest. While, in general, the research output has high academic excellence, it is clear that most of the research work carried out by the majority of the groups lacks relevance to Portuguese industry needs, judging by the very few industrial connections of the research projects. In the long term this can have some draw backs to the research and national industrial community. A way to implement connections between some of the research themes and the Portuguese industrial needs should be thought of. Some of the suggestions presented in the book “Profile of scientific research in Portugal – Materials Science and Engineering”, given to the evaluators during their stay, deserve attention.

A way should also be found to pioneer industrial use of the high technical output found in the work of some groups. This matter should be taken up at the policy forming level.

9. It was also noticed that there was seldom-adequate qualified technician and staff support for the unit’s activities. The lack of technical support can seriously limit the full use of the sophisticated equipment, and it could be a burden on highly qualified scientists. This problem will certainly be difficult to solve with the present policy of short-term recruitment since a good technician takes time to become efficient. A way has to be found to overcome this situation. Perhaps a restriction in provision of funds for acquisition of expensive equipment only to the Universities and Research Laboratories that are willing to provide adequate technical staff could help in the solution.
10. Although good examples of innovative and inspiring leadership were found this was rather the exception than the rule. Lack of leadership and of coherent strategy was sometimes found. This was particularly true in the bigger research units and is a serious weakness, which limits their potential for excellence. Some suggestions concerning this matter were pointed out in the reports. It should however be pointed out that without a policy that identifies national projects, covering a wide range of areas of research, development and technology transfer activities, it will not be easy to avoid the excessive thematic fragmentation many times found within the research units.

4.4 CHEMICAL ENGINEERING AND BIOTECHNOLOGY / ENGENHARIA QUÍMICA E BIOTECNOLÓGICA

EVALUATION IN PROGRESS / AVALIAÇÃO EM PROGRAMAÇÃO

4.5 ELECTRICAL AND COMPUTER ENGINEERING / ENGENHARIA ELECTROTÉCNICA E INFORMÁTICA

Panel Coordinator:

José M.F de Moura

Professor of Electrical Engineering and Computer Science (Visiting) Massachusetts Institute of Technology
Cambridge, USA

Evaluation Panel - 1:

Adel Razek

Laboratoire de Génie Electrique de Paris SUPELEC, Gif-sur- Yvette, FR

Christopher Rose

Rutgers WINLAB, New Jersey, USA

David Padua

University of Illinois, Urbana Champagne, USA

Franco Maloberti

Department of Electronics Pavia University, Pavia, IT

Janak Patel

University of Illinois , Urbana Champagne, USA

Prathima Agrawal

Telcordia Technologies , Morristown, USA

Richard S. Bucy

Aerospace Engineering Dept and Dept of Mathematics, Univ. of Southern California, USA

Tariq S. Durrani

Signal Processing Division, Dept of Electronic & Electrical Engng, Univ. of Strathclyde UK

Yale Patt

The University of Texas at Austin, USA

Evaluation Panel - 2:

Charles E. Thorpe

Smith Hall, Robotics Institute Carnegie Mellon University, USA

Ernst Dieter Dickmanns

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Evaluation

The evaluation of the **Electrical Engineering and Computer Science (EECS)** Research Units covered twenty-four Units and was organized in two visits:

The first visit took place from December 7, 1999 to December 14, 1999 and evaluated fifteen Units. These Units cover a broad range of scientific areas including the following: Telecommunications Systems, Communications Networks, Signal Processing, Computer Engineering, Analog and Digital Electronics, Power, and several areas in Computer Science.

The second visit took place from January 31, 2000 to February 4, 2000 and evaluated nine Units. These nine Units encompass a broad range of scientific areas including the following: Robotics, Control, Signal Processing, Biomedical Engineering, Artificial Intelligence, Power Electronics, Networking, Computer Integrated Manufacturing, and many sub areas in these general fields.

This report covers both visits.

Sub-committees 1 and 2

The following individuals formed subcommittee 1 (December 7-14, 1999):

Dr. Prathima Agrawal (Telcordia, Murray Hill, NJ, US)
Prof. Richard S. Bucy (University of Southern California, Los Angeles, CA, US)
Prof. Tariq Durrani (Strathclyde University, Glasgow, UK)
Prof. Franco Maloberti (Universidade de Pavia, Italy)
Prof. José M. F. Moura (visiting Massachusetts Institute of Technology, Cambridge, MA, on sabbatical leave from Carnegie Mellon University, Pittsburgh, PA, US) (Coordinator)
Prof. David Padua (University of Illinois, Urbana Champaign, IL, US)
Prof. Janak Patel (University of Illinois, Urbana Champaign, IL, US)
Prof. Yale Patt (University of Texas, Austin, TX, US)
Dr. Adel Razek (CNRS, Paris, France)
Prof. Chris Rose (Rutgers University, Brunswick, NJ, US)

The following individuals formed subcommittee 2 (January 30-February 4, 2000)

Ernst Dickmans (Universität der Bundeswehr, Fakultät für Luft-und-Raumfahrttechnik, Institut für Systemdynamik und Flügmechnik, Nuebiberg, Germany)
Steve Marcus (Department of Electrical Engineering and Institute for Systems Research, University of Maryland, University Park, MD, US)
José M. F. Moura (visiting Professor of Electrical Engineering, Massachusetts Institute of Technology, Cambridge, MA, on sabbatical leave from Carnegie Mellon University, Pittsburgh, PA, US) (Coordinator)
Madhu Pandit (Universität Kaiserslautern, Fachbereich Elektrotechnik und Informationstechnik, Lehrstuhl für Regelungstechnik und Signaltheorie, Germany)
Marwan A. Simaan (Bell of PA/ Bell Atlantic Professor, Department of Electrical Engineering, University of Pittsburgh, Pittsburgh, PA, US)
Williams Swartout (Director of Technology, Institute for Creative Technologies, University

of Southern California, Marina Del Rey, CA, US)

Charles Thorpe (Head of Robotics Master's Program, Robotics Institute, School of Computer Science, Carnegie Mellon University, Pittsburgh, PA, US)

Overall Organization

The visits were organized locally by Prof. Manuel Heitor, the overall coordinator of the evaluation, and by Dra. Maria José Camecelha de Abreu. The subcommittees were accompanied and assisted during the evaluation and the visits by Dra. Abreu, Dr. Miguel Oliveira, and Dra. Anabela Cardoso from the Observatório das Ciências. Dra. Cardoso accompanied only subcommittee 1. The Panels fully appreciated their efforts that determined the success of the visits.

Subcommittee 1 met twice with Prof. Luís Magalhães, President of the Fundação da Ciência e Tecnologia (FCT): on Tuesday December 7 and on Monday December 13, 1999. Prof. Manuel Heitor also attended the second meeting.

Subcommittee 2 met once with Prof. Luís Magalhães, President of the Fundação da Ciência e Tecnologia (FCT): on January 30, 2000 and with Prof. Manuel Heitor on Friday February 4, 2000.

During these meetings, Prof. Magalhães and Prof. Heitor explained at length the goals of the evaluation, the funding mechanisms of the FCT, and replied to the numerous questions raised by the Panel members. These meetings were very important in clarifying the overall mission of the Panels.

Research Units

The research units visited are listed in the two tables below.

Table 1: Units visited by subcommittee 1

Unit #	Unit Name
12	Instituto de Telecomunicações – IT (IST, Lisboa)
49	Centro de Estudos de Física, Acústica, e Telecomunicações – CEFAT (FEUP, Porto)
95	Grupo de Electrotecnia Teórica e Medidas Eléctricas – CETME (IST, Lisboa)
119	Centro de Investigação de Sistemas Eléctricos – CISE (FEUP, Porto)
122	Instituto de Telecomunicações – IT (UA, Aveiro)
127	Instituto de Engenharia de Sistemas e de Computadores – INESC (UA, Aveiro)
174	Centro de Investigação em Engenharia Biomédica – CIEB (FEUP, Porto)
175	Instituto de Telecomunicações – IT (FCTUC, Coimbra)
218	Centro de Energia Eléctrica – CEEL (IST, Lisboa)
307	Instituto de Engenharia de Sistemas e de Computadores – INESC (IST, Lisboa)
308	Instituto de Engenharia de Sistemas e de Computadores – INESC (FCTUC, Coimbra)
319	Centro ALGORITMI (Universidade do Minho, Guimarães e Braga)
322	Instituto de Engenharia de Sistemas e de Computadores – INESC (FEUP, Porto)
326	Centro de Informática e Sistemas – CIS (FCTUC, Coimbra)
821	Centro de Análise e Processamento de Sinais – CAPS (IST, Lisboa)

Table 2: Units visited by subcommittee 2

Unit #	Unit Name
27	Lab. de Inteligência Artificial e Ciência de Computadores – LIACC (Porto)
46	Instituto de Eng ^a Mecânica – Grupo de Inteligência Artificial (IST, Lisboa)
48	Instituto de Sistemas e Robótica – ISR (Coimbra)
66	Centro de Robótica Inteligente – CRI (UNL, Lisboa)
86	Centro de Automática da Univ. Técnica de Lisboa – CAUTL (IST, Lisboa)
101	Instituto de Sistemas e Robótica – ISR (Lisboa)
139	Centro de Investigação de Eng ^a Aplicada – CIEA, CIM and AI (Politécn., Porto)
147	Instituto de Sistemas e Robótica – ISR (Porto)
207	Centro de CIM do Porto (IDIT, Porto)

Calendar of Visits

The tables below give the calendar of the visits with the approximate times of each visit. We also indicate the members of each subcommittee that visited each Unit.

Table 3 Units visited by subcommittee 1

Day of Visit	Time	Unit #	Panel Subgroup
Tuesday, 12/ 7/ 1999	15:00 – 17:00	218 CEEL (IST, Lisboa)	Bucy, Durrani, Maloberti, Moura, Radzek, Patel
Tuesday, 12/ 7/ 1999	17:00 – 18:30	95 CETME (IST, Lisboa)	Bucy, Durrani, Maloberti, Moura, Radzek, Patel, Patt
Wednesday 12/ 8/ 1999	11:00 – 17:30	326 (CIS, Coimbra)	Bucy, Moura, Padua, Patel, Patt
Wednesday 12/ 8/ 1999	11:00 – 14:30	175 (IT, Coimbra)	Durrani, Maloberti, Radzek, Rose
Wednesday 12/ 8/ 1999	15:00 – 19:00	308 (INESC, Coimbra)	Durrani, Maloberti, Radzek, Rose
Thursday 12/ 9/ 1999	9:00 – 12:00	122 (IT, Aveiro)	Agrawal, Durrani, Moura, Radzek, Rose
Thursday 12/ 9/ 1999	12:00 – 14:30	127 (INESC, Aveiro)	Agrawal, Durrani, Moura, Radzek, Rose
Thursday 12/ 9/ 1999	16:00 – 17:30	49 (CEFAT, Porto)	Agrawal, Durrani, Moura, Radzek, Rose
Thursday 12/ 9/ 1999	17:30 – 19:00	119 (CISE, Porto)	Agrawal, Durrani, Moura, Radzek, Rose
Thursday 12/ 9/ 1999	11:00 – 18:00	ALGORITMI (Guim/Braga)	Bucy, Maloberti, Padua, Patel, Patt
Friday 12/ 10/ 1999	9:00 – 15:30	322 (INESC, Porto)	Agrawal, Maloberti, Padua, Patel, Patt, Radzek, Rose
Friday 12/ 10/ 1999	9:00 – 13:30	174 (CIEB, Porto)	Bucy, Durrani, Moura
Saturday 12/ 11/ 1999	9:30 – 19:00	307 (INESC, Lisboa)	Whole sub-committee
Monday 12/ 13/ 1999	10:30 – 12:30	821 (CAPS, Lisboa)	Bucy, Durrani, Maloberti, Moura, Patel, Rose
Monday 12/ 13/ 1999	12:30 – 19:00	12 (IT, Lisboa)	Whole sub committee 1

Table 4: Units visited by subcommittee 2

Day of Visit	Time	Unit #	Panel Subgroup
Monday, 1/ 31/ 2000	9:00-13:30	66 CRI (UNL, Lisboa)	Dickmans, Marcus, Moura, Pandit, Simaan, Swartout
Monday, 1/ 31/ 2000	14:00 – 17:00	86 CAUTL (ISL, Lisboa)	Dickmans, Marcus, Moura, Pandit, Simaan, Swartout
Tuesday 2/ 1/ 2000	9:15-14:30	48 ISR (Coimbra)	Whole committee
Tuesday 2/ 1/ 2000	15:30-18:00	207 CIM – IDIT (Porto)	Whole committee
Wednesday 2/ 2/ 2000	9:00-13:30	147 ISR (Porto)	Whole committee
Wednesday 2/ 2/ 2000	14:00-16:30	27 LIACC (Porto)	Marcus, Moura, Swartout, Thorpe
Wednesday 2/ 2/ 2000	14:00-16:30	139 CIEA CIM and AI (Porto)	Dickmans, Pandit, Simaan
Thursday 2/ 3/ 2000	9:00-15:15	101 ISR (Lisboa)	Whole committee
Thursday 2/ 3/ 2000	15:20-17:30	46 AI-IDMEC	Whole committee

Methodology

Typical Visit

A typical visit started with an overall presentation of the Unit by the Unit Leader that reviewed the activity and accomplishments of the Unit in the last three years. This session ended with a brief question and answer period. The initial session was followed by visits with the several groups of the Unit. The Panel engaged in pointed discussions to understand the scientific and technical problems pursued by the individual researchers, their specific approaches, contributions, and results, and how they viewed their work in the international context. The visit usually ended with a final session where the Panel addressed parting issues of a global nature. The Panel took this opportunity to determine any constraints to their activity as perceived by the researchers and the Unit management, as well as to clarify the Unit’s vision and future directions.

Panel Discussion

The subcommittees held plenary sessions after the visits. Subcommittee 1 held a whole day discussion on Tuesday December 14, 1999, and subcommittee 2 held a whole day discussion on Friday February 4, 2000. During these plenary sessions all members of each subcommittee discussed each Unit at length¹. The Panel voted on a scale of 1 (poor) to 5 (excellent) on each subgroup, on the leadership of the Unit, and on the Unit as a whole. These evaluations translate a qualitative assessment that goes beyond the multiple quantitative indices used by the evaluators in their work.

¹ The coordinator did not take active participation in the discussions or votings of most Units related to IST, in particular, Inesc – Lisbon, ISR – Lisbon, and IT – Lisbon.

Programmatic Funding

The subcommittees discussed the criteria and goals for distribution of the Programmatic Funding. During their sessions with the President of the Fundação da Ciência e Tecnologia (FCT), Prof. Luís Magalhães, and their sessions with the Overall Coordinator of the Evaluation Panels, Prof. Manuel Heitor, the Panels were briefed on the FCT objectives for this type of funding. The understanding was that Programmatic Funding is opportunistic and targeted to making a definitive difference in the *research* activity of a researcher, a group, or a Unit.

It was agreed that programmatic funding should not be directed to support infrastructure costs like utilities and building maintenance costs. It was decided that this was not the purpose of these funds and such use would not correspond to the best application of this funding. Such costs are to be covered by regular funding mechanisms to be negotiated by the Unit with the University with which it is primarily associated and/ or with FCT.

Both subcommittees decided to apply the Programmatic Funding along the following major directions:

Support of individual researchers with an incipient funding basis, whose activity shows promise and should be supported. Typically, these researchers joined recently their current Unit, or are part of a Unit with major identified weaknesses. This funding will help these researchers to launch or sustain their activity in the near future.

Support certain groups whose activity was ranked excellent and for which the programmatic funding will help recruiting post-docs, support otherwise unsupported research activities, or strengthen their national and international relations.

Fund the activity of selected research groups from several Units working in certain scientific areas. These areas were chosen because of their strategic importance, their relative weakness in the context of Portugal, and the existence of promising research efforts in several of the Units. The funds allocated to these groups will hopefully seed national initiatives that will strengthen the overall presence of Portugal in these areas. Although allocated to the individual groups, it is expected that these researchers and their Units will coordinate their activities and resources to foster synergisms that will amplify the overall impact of these funds and their research. Examples of such activities include the following: inter-group meetings to define strategy, research priorities, or to report research results; coordinating longer stays of a senior foreign researcher, or of a post-doc, that is principally housed in one of the Units but who can visit or interact for shorter periods of time with other research groups; and sharing of specialized research facilities that, when it makes sense, can be used and accessed by researchers from different Units.

In a few cases, the programmatic funding is allocated globally to the Unit with responsibility given to the management of the Unit to determine their best use.

Recommendations Subcommittee 1

Besides the recommendations specific to each Unit, which are included in the individual reports, subcommittee 1 identified several general issues that are listed here.

Inbreeding and Internationalization

The long-term quality of the research in Portugal may be strongly affected by the high level of inbreeding observed in the research Units. The Panel understands that this is a direct consequence of the existing recruiting policies at the Portuguese Universities and the low degree of mobility of Portuguese faculty members.

It is important that the research Units counter these effects by strengthening their international research ties, including the following: recruiting in the international arena post-docs and graduate students; sending abroad their own graduates as post-docs; senior researchers spending sabbaticals in foreign Institutions; inviting foreign senior researchers to spend extended periods of time at the Units; team with foreign groups in common research projects.

Research Evaluation

Our evaluation emphasized the research being carried out by the research group. During our visits, we attempted to assess the quality of the research activity in terms of several factors including the ability to define the problem being pursued, its relevancy, the approach taken, and the intellectual contributions of the work. We were interested in determining for each research endeavor what were the issues being pursued – a good concise definition of the problem – why the work was carried out, what were the important open questions that were identified, how the researcher(s) were pursuing these questions (the approach and specific methods), and finally the results obtained by the researchers, how they fared against other approaches, what did this work contributed as new knowledge.

We frequently asked rhetorical or provocative questions – what is the result you are most proud of in the last three years, who are the top researchers addressing similar problems, what are they concerned with, what is the most compelling result from your competitors? What was the key ingredient in your approach? What has been the impact of your research in the wide world arena? We often engaged the researchers in pointed discussions. While we were genuinely interested in the results, it is true that our questions had the specific goal of exacting clarifying answers that helped us in our evaluation.

Often the researchers gave us complete and appropriate answers. Clearly, the ability to describe the actual research and sustain a related in depth discussion helped the evaluators accomplish their mission. Some other times the researchers did not address appropriately the issues we raised, limiting their presentations or arguments to describing in general terms what others did and why the area was important.

Unit

There are many good reasons justifying the existence of research Units. Besides a least common divisor of related research interests and sharing of resources, a successful Unit congregates high quality research groups that interact synergistically and are committed to a broad well-defined strategic goal. Beyond managing the Unit resources and the day-to-day activities, the role of the Unit leadership, together with the Unit researchers, includes pursuing and creating new opportunities and continuously developing the vision of the Unit. Rather than conforming to the status quo, the leadership of such a Unit proactively articulates solutions that exploit to the maximum the Unit comparative advantages.

In several Units we found a dynamic and optimistic leadership that presented us with a clear strategic vision of why the Unit existed and where it was going. In others, we had the feeling the Unit was a federation of researchers loosely joined together due to historical reasons or geographical proximity.

Written Reports

With a few excellent exceptions, we found the reports to be poorly organized and poorly written. They were usually massive volumes, unfortunately containing inappropriate information for the evaluation. Even if, as claimed often by the Units, the current structure for these reports as defined by FCT is not the most appropriate, we found that frequently the Units did not focus their presentation on the goal of describing their vision, their resources, the problems they are tackling, the approaches they are taking, the results they are obtaining. In the future, the Units should emphasize their message as it pertains to the evaluation. To help this goal, we propose that the reports be streamlined, and that their structure be completely reorganized. The current use of forms that load upfront the reports with irrelevant information should be completely overhauled. We suggest that FCT review the Instructions for Proposal Preparation from some other Funding Agency like the National Science Foundation or the Defence Advanced Research Programs Agency from the US Government with which many members of the Panel were familiar. These Instructions could be adjusted to serve the specific goals of the evaluation. Additional specific recommendations are contained in the report of the sub-committee 2..

Infrastructure Costs

We understand that the majority of the research Units, regardless of their legal status, are housed in buildings that are part of a University or Institution of Higher Learning that supports the main infrastructure costs, including the building's maintenance, heating and air conditioning, water and utilities. This conforms to the experience of the Panel members. Universities can recover these expenses through overheads taxing the research contracts. Also, the research Units in general have a determinant role in education both at the licenciatura and the post-graduate level, since student projects and theses are pursued in these Institutions. We saw numerous examples of this in the many Institutions we saw. The widespread involvement of 3rd, 4th, and 5th licenciatura students in research projects is actually one of the most positive, and in certain aspects unique, factors of the research Units in Portugal. It is only natural that Universities assume the infrastructure costs of these Units.

However, several of the INESCs reported that they had to support their own infrastructure costs. This is at odds with the strong educational role that these Institutions play given that they involve a very large number of licenciatura and post-graduate students in their research projects. This clearly places a burden on these Units that unfairly penalizes the activity of their researchers. Surprisingly, while the amounts involved encumber heavily the research budget of these Units, it should have a small impact on the budget of a University. For example, INESC – Lisboa explicitly stated that they would like to be considered part of Instituto Superior Técnico. We understand that there are patrimonial issues and a historical that need to be addressed. However, we see no reason why the young researchers that have joined these Units more recently should inherit this predicament. We urge FCT to find an interim solution as soon as possible by providing these Institutions with additional funding (beyond the basic, programmatic, and project funding) to cover these expenses, and serve as a mediator between the researchers at these INESCs and their home Universities as they look for a permanent solution.

Fellowships

One issue that was consistently raised by the management of the research Units was their inability to fund with FCT fellowships the first year of MSc. students. This was confirmed in our discussions with Prof. Magalhães, President of FCT. Apparently the existing fellowship programs preclude support for first year MSc. students, and only 15 % of second year MSc. students are supported by FCT fellowships. This contrasts with the 50 % success rate of PhD fellowship applicants. Prof. Magalhães explained to the Panel that this corresponds to an assumed scientific policy of FCT. FCT interprets the current MSc. programs that follow the 5-year licenciatura program and possibly extend over several years, as professional MSc. degrees. FCT sees as its primary mission to fund research, not professional degrees, and has targeted their fellowship programs towards supporting PhD. students. The Panel finds no fault with these FCT goals. Shortening the total length of the Licenciatura + MSc. degrees seems to be desirable, and could represent a move towards solving this issue. There was discussion of a combined or integrated degree, as now practiced by some US Institutions (e.g., CMU, MIT).

Whatever the long-term solution, this is an important issue that affects in particular the EECS Units, since there is a plentiful job market where job opportunities abound in EECS. If recent EECS graduates enter the job market upon graduation, it becomes extremely difficult for the Units to recruit them back. This is true of this area, and might be different in other areas. We encourage FCT to adopt a flexible approach and consider a short-term solution for EECS graduates.

In addition, it was not clear to the Panel that the FCT policy regarding these issues is well known and understood by the Units. FCT is not against supporting recent licenciados.. FCT encourages and supports with fellowships graduate students that enter their PhD program immediately upon graduating with their licenciatura degree. Further, FCT supports researchers that have been budgeted and work full time in a research project funded by FCT. We encourage FCT to continue dialoguing with the Units on these issues.

Publications

The Panel noticed a significant increase in the rate of publishing of the Portuguese researchers both at the level of International Journals and International Conferences. We strongly encourage them to continue this trend. Journals and Conferences serve different purposes. High quality Journals are archived. Conference Proceedings are not. Papers in high quality Journals are subject to a strenuous review and constitute a perennial contribution. Conference publications are a quicker means to publication, and an opportunity to present to a large audience the work and receive immediate feedback. Workshops are smaller forums that provide good opportunities for interaction. We note that in some areas of EECS, certain Conferences may be as selective as the best Journals.

We strongly advise the researchers to exercise good judgment in their choice of Journals, Conferences, and Workshops where to publish and which to attend. We all should know what the best Journals and Conferences are in our own area – these are the places where we should publish. Why waste a good result in the wrong place where no one will notice. On the contrary, publishing in second-rate venues (Journals or Conferences), and attending less than top quality Conferences should strongly be discouraged.

Faculty Resources and Teaching

Since the research Units we visited are strongly associated with Universities, and the majority of the senior researchers are faculty members, it is clear that the teaching and research activities are intertwined. Major constraints to the activity of the researchers in Portugal as compared to researchers in other major research Universities, as for example in the US, are the seemingly unreasonable lack of flexibility in recruiting and managing the teaching faculty. Addressing to satisfaction these issues may require action at the level of Academic Departments, or Universities themselves. It may also require coordination at a higher level, directly between the Minister of Science and Technology and the Minister of Education. We touch upon some of the issues raised during our visits.

(i) Filling new positions (concurros) is a standard way for Universities to overcome perceived weaknesses and build strong programs in strategically important areas. This seemed to be a foreign concept to the majority of researchers and faculty members we talked to, for whom this seemed to be only a promotion tool.

(ii) It is important that Universities account in the duties of their faculty members the whole range of activities with which a faculty member is involved: certainly teaching, research, advising of licenciados, MSc. theses, PhD. theses, committee work, leadership positions of research Units and other University organizations. Being able to reduce in a given semester the actual teaching load to launch a research initiative, or to focus on research could be very useful to a faculty member. The concept of teaching buy out – with clear rules to avoid abuses – could introduce a useful degree of flexibility.

(iii) The number and variety of courses and specializations offered within the teaching Departments seemed quite large, which forced apparently faculty members to switch often to new courses to guarantee these offerings, and also that the same faculty member be involved in teaching more than one course per semester. We understood that this had much to do with the way Universities are currently being funded.

(iv) The number of weekly contact hours (6 hours) seems to be manageable (in many US Universities it can go from 3 to 6). However, these contact hours often are met by teaching more than one course in the same semester. More troublesome seems to be the extended evaluation period and the numerous ‘final’ exams that a professor has to give during the same semester for the same course. We were told that, although the number of teaching weeks is about 12 or 13 per semester, the two semesters end up spanning practically the best part of eleven months, leaving only a bit over a month in the Summer free of teaching duties. This is a major limitation to the research activity of the research Units. To the Panel it is well within the scope of Universities to design a calendar year that concentrates all yearly teaching activities in semesters of no more than 17 or 18 weeks (15 week classes + 2 or 3 week exam period), freeing the researchers during a period of 3 to 4 months in the summer for their research.

(v) An issue that arose with at least one of the Units is the type of teaching activity. In this particular Unit the Panel was told that the researchers were always assigned large second year courses, preventing them from teaching upper class and graduate courses. This has several problems. The large courses represent a heavy burden that absorbs every semester the bulk of their activity. Being unable to teach upper class courses prevented these researchers from their contact with the potential pool of 4th and 5th year students, which limits their recruiting ability. Teaching graduate and advanced courses in a researcher’s own research area help build a research group. It seems to the Panel that, in general, a broad range of faculty members can teach sophomore and junior level courses (2nd and 3rd year courses). With reasonable scheduling, faculty members that in the current system have been primarily assigned to teaching the lower class courses could be freed every so often from such heavy teaching load. Again, this seems to be a problem that can be resolved by the teaching faculty of each University.

Intellectual Property (IP)

As a truism, research institutions are in the business of advancing knowledge, but those in technology areas like EECS also have as one of their goals technology transfer. There are many ways to achieve this including contracting research with companies, licensing the research results to companies, partnering with companies, spinning off new companies that will develop the new technology. We already saw successful instances of these different ways in some of the research Units we visited. Without being exhaustive, we mention a few examples: Instituto de Telecomunicações’s (IT) connection with the Research Center from the Portuguese Telecom (PT), which has spun a number of PT funded projects; the connection of the digital electronics group at INESC – Lisboa with the US company Cadence, which considers them as one of their three European virtual Laboratories; the relation of the INESC – Lisboa solid state group and clean room with several disk storage US companies (e.g., StorageTek); the microelectronics group at IT – Lisboa which has spun a successful spin-off company with major contracts with several silicon valley companies and, in the words of their leader, is one of the very few Portuguese companies recruiting PhD graduates.

Technology transfer raises the issue of intellectual property (IP) and IP protection. We initiated at several Units a discussion on IP protection to understand how this question is being addressed in Portugal. We found that the Portuguese researchers often have no clear

understanding of how to do it or what the implications are. From our point of view, there are very pragmatic questions that relate to fair retribution and royalties. We have no clear idea of what are the proper models for Portugal. We suspect that there will be a range of different options that should apply in different circumstances. There are no easy solutions; we encourage FCT, the Universities, the Units, and the researchers to engage in a broad discussion on this subject. We also encourage FCT and the Universities to develop mechanisms that can support IP protection (including disclosure and patent filing) and educate the Portuguese researchers on these issues.

Research Areas

We have a few selective remarks concerning the status of research in Electrical Engineering and Computer Science (EECS) in Portugal. We do not intend to be exhaustive, and apologize for leaving out in our comments many of the worthwhile and outstanding efforts that are going on in Portugal. For these we refer to each Unit's report. We note also that the 15 Units visited do not represent the Universe of EECS research Units in Portugal, so that some of our observations may be quite off the mark. Having stated this, we do think that it is useful to make the following comments.

The Units we visited cover among others the following areas: Power Engineering; ElectroMagnetics; Solid State; Electronics; Signal Processing; Bioengineering; Telecommunications; Computer Engineering, and Computer Science.

Definitely, we saw excellent work in many Electrical and Computer Engineering areas. Without being exhaustive we note the following: some aspects in Signal and Image Processing, e.g., at INESC – Lisboa, Instituto de Telecomunicações (IT) – Lisboa, INESC – Aveiro; communication modulation theory as well as antenna array design at IT – Lisboa; Bioengineering at CIEB, Faculdade de Engenharia da Universidade do Porto; solid state and micro electrical machines (MEMS) at INESC – Lisboa (although here it seemed almost the effort of a highly dynamic and successful single individual); the CAD/ VLSI work at INESC – Lisboa, and at Instituto de Telecomunicações – Lisboa.

We single out also the optical propagation component and system work going on at Instituto de Telecomunicações – Aveiro, and at INESC – Porto. We didn't see much interaction between these two groups; they may want to explore possible synergisms. We also think that the combined expertise of these researchers represents a unique resource. We wonder what would be needed to take their technology to the next step of system development and technology transfer.

We note some major insufficiencies.

In Telecommunications, in particular in the areas of computer communications networking and switching, and wireless communications, we saw quality groups that are either starting their activity with a good positive slope, or are working in somehow narrow aspects of the area. We strongly encourage the appropriate research Units to nurture and develop these areas. We propose below a concerted effort to attain this.

Computer Engineering (CE) and Computer Science (CS) are surprisingly generally weak in the research Units we visited. Given that we visited the research Units of at least 5 of the

major Engineering Schools in the country with interests in CE and CS this raises a strong flag. Of course we saw excellent work in artificial intelligence (AI) work and dependable computing research, as well as a beginning good effort in databases, at Centro de Informática e Sistemas (CIS), Faculdade de Ciências e Tecnologia da Universidade de Coimbra. We understand that some other areas in CE and CS like robotics, computer vision, and also AI may be covered by other research Units not visited by this subcommittee.

It is surprising that the weaknesses we sensed are in some of the basic areas in CE and CS, including traditional areas such as computer architecture, compilers, operating systems, programming languages, artificial intelligence, and graphics. We strongly encourage the research Units and FCT to look carefully to their weaknesses in CE and CS.

Two Research Initiatives: Networking and Wireless

Portugal lacks coherent research programs in networking and in wireless. These are serious deficiencies that should be corrected. Optimally, a number of faculty members should be hired at both senior and junior levels along with additional support for students and postdocs in each of these areas so that strong programs could be initiated. Unfortunately, such an approach seems impractical for a variety of reasons.

We therefore suggest that two nationwide programs be designed based on coordinated postdoctoral training. We have allocated programmatic funding to those Units where we find core expertise to build upon. These funds should serve as seed funding to boot strap these two initiatives and should be complemented by other funding, including FCT and European project funds to which the researchers are strongly encouraged to apply.

We envisage each of these programs structured in a similar fashion, each being sculpted by an international team of distinguished professors and being initially led by one or more team members during sabbatical year(s) spent in Portugal. Postdoctoral fellows will appropriate the necessary knowledge at various institutions worldwide and return with the expertise necessary to conduct research in each of the areas – from theoretical studies through implementation of prototypes.

The key to these programs will be tightly enforced collaboration between the postdocs of the participating institutions in Portugal – in some ways a group into and of itself, but one which spans multiple institutions and associated native expertise.

We note that although the two efforts should run independently, there is much to be gained by establishing from the start strong interactions between them.

Wireless Networking Initiative This program should span four institutions identified as likely incubators for an internationally prominent wireless networking program: IT – Lisboa, IT – Aveiro, INESC – Porto, and ISR – Lisboa².

Senior foreign researchers and postdocs should be recruited to broaden and / or strengthen existing expertise including RF systems, RF and CMOS ICs for high speed adaptive

² Subcommittee 2 decided that the wireless activity in ISR – Lisbon should also be part of this initiative.

wireless transceivers (IT – Aveiro, IT – Lisboa), networking protocols (IT – Aveiro), wireless communications system theory, structure and algorithms (several groups at IT – Lisboa, including the communications signal processing group), systems development/integration and exploratory development (INESC – Porto).

Networking Initiative This program should span four institutions identified as likely incubators for an internationally prominent networking program: IT – Lisboa, IT – Aveiro, INESC – Porto, and CIS – Coimbra. These groups should cooperate to establish a strong networks effort covering areas from modeling and performance, to protocol development and evaluation, to experimental and integration testbeds.

These two initiatives should collaborate between themselves. Taken together they could bootstrap a strong activity in wireless and networking. It is also important that these groups collaborate and involve in their efforts the optoelectronics groups at INESC – Porto and at IT- Aveiro.

Final Comments

Reading the evaluation reports of the 1996 evaluation, the Units reports, and from our discussions with the research Units, it is clear that much progress has occurred in the last three years.

Electronic Newsletter Concerns with funding mechanisms were prevalent in the 1996 review. This time there was in general a much better understanding and acceptance of the funding mechanisms. A few complaints were voiced regarding the periodicity of the project funding. Still, there were cases of Units visited that lacked the information that a call for proposals (ending in January 31, 2000) was pending. Also, as noted above, the fellowship program is not well understood. We think that it is important for FCT to continue explaining and advertising its funding mechanisms as broadly as possible. FCT could have at the very least an *electronic* newsletter periodically e-mailed to ALL the research Units and Academic Departments in Portugal, as well as to ALL registered researchers.

Beyond Project Funding To our understanding FCT has now a funding portfolio that includes the following mechanisms: basic funding; programmatic funding; projects; and fellowships.

The projects are designed as a single principal investigator research project, a well-defined small team of researchers addressing a relatively well-focused research problem. The call for projects are usually open by broad research areas and the selection criteria emphasize the quality of the work proposed, of the research team, and the reasonableness of the proposal.

We suggest at least two additional funding programs that should address two major limitations (as we see) from the current available programs: infrastructure proposals, and target system level projects. We understand that these types of proposals may be very specific to the Electrical Engineering and Computer Science area.

Infrastructure and equipment funding As referred to us by several Units, in the early 90's there was a major funding programming for research infrastructure. This covered

major equipment grants. The equipment acquired then has now in many cases become obsolete. Small workstations and computing equipment can still be acquired through the project funding mechanism when appropriately budgeted. However, it is important to have on a yearly basis a regular call for equipment proposals addressing major needs of a group, several groups, or a research Unit. For example the National Science Foundation (NSF) in the US has on a regular basis calls for infrastructure proposals at two levels of funding.

System level projects In the EECS area it is important to have the possibility every year of applying for a few large projects. These projects go well beyond the level of a single PI type project. They should enable the interdisciplinary teaming of several researchers, possibly encompassing more than one research Unit. These should be thematic and correspond to initiatives lasting possibly from 3 to 5 years. These projects should cover strategic areas to be developed, and there should be in place a tight overseeing mechanism. There are several recent NSF initiatives of this type in the US. Also, typical of this type of funding are many programs of the Defence Advanced Research Projects Agency in the US.

European Funding We encourage strongly the Portuguese researchers to team with other European partners to apply to European funding programs. In particular the Fifth Program has a significant budget for the Information Technology areas. We sensed in some discussions with Portuguese researchers reluctance in applying for these funds, with the argument that they are not research oriented. Some of us in the Panel had a different understanding, and we urge the Portuguese Units not to pass these opportunities. Also, there is an understanding at the highest level between the US Government and the European Unit for joint research programs under the umbrella of the Fifth Program and corresponding US research programs. Although, as far as we know, these transatlantic projects are subject to double jeopardy (meaning dual independent evaluation, in each side of the Atlantic), they represent an opportunity to enlarge the research contacts of the Portuguese Institutions, to include US partners.

Internet Access The 96 final EECS evaluation report strongly supported the establishment of a national high-speed network linking all the research Units among themselves and the outside World. From our own experience this time, when we tried to read e-mail at our home Institutions from several of the Portuguese units we visited, it is clear that it is still a long way to achieving that goal. Nowadays, the Internet is in itself one of the richest resources available to the research community at large. Being difficult to access the outside World, or being accessed by the outside World, is similar to being invisible to this same World. On the other hand, the Internet is in a sense the greatest equalizer. To realize this potential it is most important that the Portuguese research Units have a transparent high-speed access to the World Wide Web. This may be the major single constraint that we detected in our evaluation affecting the Portuguese research Units.

Recommendations Subcommittee 2

Besides the recommendations specific to each Unit, which are included in the individual reports, subcommittee 2 identified several general issues that are listed here.

Written Reports

The written reports were in general poorly organized, with the exception of the report of one Unit. The report should be organized in the following way. Each report should begin with a mission statement, stating the strategic goals of the Unit. This mission statement should be arrived at with input and agreed upon by researchers in the center. This should be followed by a description of the research groups. Each research group should choose how to best demonstrate the impact of their research: list of publications, or description of industrial relations, or list of international contacts, or list of key prototypes or list of recent PhD graduates. Rather than having a vita for all members of the staff, it would be more helpful to have a one-page vita for the key professors, and a table that summarizes the information for the staff (most recent degree and institution, laboratory and department affiliation). The vitas should be in an Appendix. The report should also have a table summarizing, for each research group and for the Unit as a whole the total funding for each project: funding source, total funding, duration, research funding, and (most important) what fraction of the total funding of the project per year comes to the Unit.

Oral Reports

The visiting review panel would like to see the following during a site visit:

Demos. It is always more impressive to see software or hardware really working, rather than to hear a description. If a live demo is not feasible, sometimes a video is a good substitute.

Technical discussion. The panel wants to understand, for at least some of the research projects, what are the key areas that make this world-class research.

Posters. Many labs use posters to summarize each project; this makes it easy for the panel to get a good impression of the breadth of work in the lab, and to choose which projects are interesting for further discussion.

Summary budget information. The Director, during the initial meeting, should summarize the income and expenses of the Unit of the past and current years broken down with reference to source, purpose, etc.

Priorities. The Director should summarize requests for funding, and indicate priorities for using programmatic and basic funding.

Other issues

The most common complaint the panel heard, by far, was the heavy teaching load and frequent overload for the professors and graduate instructors. We recognize that this is out of the hands of the FCT, but would nevertheless offer some suggestions. It may be possible

to offer some limited support for graders or undergraduate teaching assistants / lab assistants, to unload some of the burden of routine tasks from the teaching staff.

A second recurring theme that the panel heard was the need for support and technical staff. In the absence of professional accountants, faculty end up spending an excessive amount of time doing the bookkeeping for European programs. Similarly, since it is difficult to hire technicians or professional engineers, it is difficult to build prototypes of sufficient maturity and size to be directly relevant to industry. In some cases, it is appropriate to have graduate students do all the technical work as part of their education. In other cases, such as underwater vehicles, there is little margin for error, and a student mistake can set back the entire project. In those situations, having professional staff for some of the engineering would greatly help the unit.

One of the cross-cutting issues that the panel noticed in almost all sites was the problem of inbreeding. Due to the structure of Portuguese universities, many PhD students are teaching assistants as graduate students, and remain on the faculty as assistant professors when they graduate. This tends to produce large groups of researchers who have been trained in the same institution and under the same advisor. This in turn inhibits collaboration among Portuguese Universities, and may decrease the quality of research by reducing the flow of fresh ideas and viewpoints. The institutions we visited are all aware of this issue, and are all working on it with varying degrees of effort and success. It seems to us important to continue international exchanges, both in terms of bringing in foreign visitors for extended stays and in terms of sending Portuguese students abroad for their graduate education and sending professors abroad for sabbaticals.

FCT had apparently attempted to increase the level of collaboration among Portuguese universities by providing special funding for the establishment of the ISR organization across the three major Universities. This appears to have had limited success. We saw no evidence that the three ISR institutions collaborate any more with each other than they do with other institutions. For instance, in underwater robots both ISR Porto and ISR Lisbon collaborate with the Naval Postgraduate School, but do not collaborate in any meaningful way with each other. FCT should realize that the current ISR organization imposes a management burden of cooperation among Universities, but does not result in any benefit. The three poles of ISR could be recognized as independent entities, eliminating the management burden of coordination.

FCT could help encourage interaction between universities and industry in at least three concrete ways. First, it should be emphasized to the Units that strong interactions with industry are considered important in the evaluations. Second, Universities should be encouraged to think about intellectual property. Few of the units with whom we interacted had any process for filing patents, looking for licensing opportunities, etc. Third, it may be possible to fund incubators and other assistance for start-up companies. Much of the economic growth in some parts of the US has been driven by spin-off companies, using ideas generated in universities with government-sponsored research. Portugal might benefit if mechanisms were put in place to encourage the same kind of economic development activities.

Creating high-tech spin-offs would also help to provide jobs for future University graduates. Until now, most PhD graduates seem to have remained in their home

institutions. As areas like robotics mature, the available teaching slots will fill up, and other opportunities will have to be found for graduates. Some should certainly be encouraged to go to the provincial universities and to Polytechnics. Others will need to move into industry, which is currently difficult.

Finally, the panel noted that Portuguese academics, like academics in much of the world, are dominated by men. It will be increasingly important to encourage women to join the faculty and to act as role models for the next generations of young women looking for career directions.

One Unit raised the issue of partial recovery of the overhead charged by the Unit projects. It is our opinion that the central Unit should receive a significant fraction of such overhead.

While some of the Units we visited were determinedly pursuing funding opportunities at the National and European level, we saw complacency and lack of aggressiveness on the part of other Units. In general this limited the impact of the activity of these groups.

As a final comment, we would like to express our appreciation for the support and expert help that we received from FCT staff throughout the duration of this visit. We were very impressed with the enthusiasm of the Portuguese researchers who are working on very challenging problems and competing with other researchers in the World.

Programmatic Funding

Rationale

It is most strongly recommended that at least part be used in the following activities:

Foster internationalization by promoting extended interactions with foreign premier research Institutions and foreign scholars.

Recruiting of postdocs (national or foreign).

Help with recruiting graduate students, as supplementary funding to cover emergencies or when other sources are not available.

Interaction with other Portuguese Groups working in similar areas.

Part of the Programmatic Funding is also directed to those Groups it was felt can best bootstrap the Networking and Wireless Initiatives referred to above.

5. Social Sciences / Ciências Sociais

5.1 ECONOMICS AND MANAGEMENT / ECONOMIA E GESTÃO

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1. Introduction

This report covers a limited set of research units in the fields of Economics and Management in Portuguese Universities – those that were visited by the panel in the 1999 evaluation cycle. These ten research units that we evaluated are identified in the Appendix. This evaluation did not include the eight research units evaluated in 1998, two of which obtained a classification of excellent. Also, the research carried out by isolated members in Portuguese universities, or by very small groups, was not part of this evaluation. This report is based on the information obtained from the reports of the research units for their activities in the period 1996-1998 and plans for 1999-2001 and on the site visits to the ten research units on October 12-15, 1999. It does not include an assessment of work done prior to 1996. For these reasons, this report should not be construed as a definitive view of the state of R&D in economics and management in Portugal.

The main criterion used in evaluating the overall quality of a research unit was the extent to which the unit had contributed to the advancement of knowledge in the world, and its potential for future contributions. The panel used an absolute, not a relative criterion as any research unit in the world would be evaluated. The panel also tried to assess the research conditions in each unit. This allowed a better calibration of the extent to which the level of research productivity was due to factors outside the control of the research units themselves.

A brief summary of our findings: Overall, the panel found that the research output in economics and management in the research units being evaluated has had some, but limited impact in adding to scholarly and professional knowledge. Individually, some units showed a significant productivity, but still at lower levels than what should be possible. The panel believes that output could be substantially improved with better-targeted incentives for and clearer scientific direction of active researchers. The panel also identified several constraints for research productivity that are outside the control of the research units and that severely limit the ability of researchers in Portugal to be productive in high-quality research.

The report is organized as follows. The next section contains a discussion of the different views and, in some cases, misperceptions about world-class research that were identified by the panel. In Section 3, we discuss important external constraints that appear to severely hinder the ability of researchers in Portuguese research units to produce an important quantity of high-quality research. Section 4 is concerned with the issue of inbreeding. Section 5 covers the issue of incentives and section 6 the issue of collaboration between the different research units. In section 7, we assess the level of research productivity. Section 8 contains our general recommendations, and section 9 concludes the report.

2. Research Perspective

The first issue in an evaluation of R&D activities in a given field is to define clearly what these activities are. The criterion used by the panel, as recommended by the Fundação para a Ciência e a Tecnologia (FCT), is the advancement of knowledge. That is, research that adds to the stock of knowledge, is well-publicized, and can be verified by the best researchers in the world in that field. In the fields of economics and management this translates almost entirely into publications in a well-defined and well-established hierarchy of international journals. Publications in these journals provide an assurance that the result is a true advance of knowledge because it is checked by well-reputed referees. This is the chief way to publicize the research in these fields so it becomes part of the body of knowledge upon which other researchers can build. All this is independent of the schools of thought or the sub-field being considered. This also applies to both theoretical and applied research, or to research that focuses on a certain region or country.

This also means, for the most part, that scholars in the fields of economics and management do not measure excellence in research by books, publications in refereed books, or presentations at conferences. There may be notable exceptions to this basic rule, but they are a clear minority and quite identifiable. This is not to say that research published in leading international journals cannot also be reported in adapted forms in conference proceedings, book chapters, and books. In the same vein, consulting activities (sometimes misperceived as applied research) do not constitute evidence of research excellence unless they result in an advancement of knowledge that is published in one of the top international journals.

This clarification of what R&D entails is not only important in understanding this evaluation, but its application in the research units can also help direct their activities towards greater excellence in research. The clear advocacy of this definition of research by FCT is already a great step in focussing efforts toward the production of world-class

research output by Portuguese research units. Its genuine adoption as a research goal by the scientific coordinators and staff of those units would achieve that desired result.

In terms of adopting this definition of research, the panel found four different patterns among the units. The leadership of some units does not have a clear understanding of what research is and appears to include purely descriptive, pedagogical, or consulting work in its definition. In a second group of research units, there is the beginning of an understanding of what research excellence in economics and management is, but a failure to grasp what is required to achieve it. For a third group, there is a clear understanding of what constitutes excellence in research and what may be required to achieve it, but with little and often unambitious progress in research productivity. Finally, in a fourth group of research units, there is both a clear understanding of what qualifies as research that advances knowledge and the production of that output for well-known international journals.

As a final point on research evaluation, we note that at the very top journals one can still distinguish among the published work in terms of degrees of importance of the contributions. Given the limited research output of the research units being investigated, this finer level of analysis is not warranted at this time.

3. External Constraints for Research in Portugal

In order to understand research productivity in a certain environment one also has to keep in mind the external constraints and conditions under which the researchers in each unit operate. Overall the panel found that the environment constraints on the researchers constitute a significant obstacle to research productivity. The most significant constraints identified by the panel are: teaching loads, administrative responsibilities, lack of compensation flexibility, academic promotion policies, and the placement of Ph.D. students.

Obviously, time spent away from research lowers research productivity. In this sense, the high teaching loads in almost all units, as reported to the panel, are difficult to reconcile with the objective of greater research productivity. In addition, in several units, the researchers had graduate teaching loads that added to the prescribed load of undergraduate teaching. Additionally, several researchers in almost all research units have serious administrative responsibilities outside the unit that take substantial time away from research.

The panel also understands that compensation for the researchers is limited and quite homogenous across the country. If researchers earn small compensation packages, they will have a greater temptation to take time away from research in more teaching, consulting, or other professional activities outside the research unit. Another way of saying this is that time dedicated towards research by unit members may require a substantial sacrifice in the researchers' personal lives.

Homogeneity of compensation packages also limits substantially the incentives available to reward greater research productivity. It may also limit activity in the internal job market among research units in Portugal.

Because all of the ten research units are part of universities, it is necessary to look at the criteria for academic promotion as part as the incentives for research. The panel understands that researchers can only be promoted when there are openings at the senior level, and this can be a substantial constraint for research incentives. Similarly, most of the hiring from outside is not done at the more senior level. It also seems that in most research units their junior members expect that their efforts in service and institutional development will play a substantial role in the promotion decision.

Finally, the panel was told that it is a “legal” requirement that, upon completing their doctorate, Ph.D. students must be offered a faculty position at the university where they are teaching assistants. Most students end up being teaching assistants in the schools in which they take their Ph.D. Consequently, this results in a substantial amount of inbreeding, an issue we address in greater detail in the next section.

The panel understands that alleviating some of these constraints requires increased resources, which may or may not be socially efficient to use for these purposes. However, several of the constraints presented above can be substantially relaxed without using any more resources. This is the case for the constraints on flexibility of teaching loads and compensation, promotion policies, and placement of Ph.D. students.

There is also some heterogeneity in terms of external constraints on researchers among the ten research units, with the expected correlation that the units with fewer constraints have, for the most part, greater research productivity. It is not clear which direction the causality goes, but it seems to make sense from a policy perspective to allow research units with greater potential to have fewer constraints. It was not clear to the panel whether such a policy exists. However, if it exists, the policy should be made transparent.

4. Inbreeding

Top research institutions in economics and management throughout the world are careful about controlling inbreeding – an institution hiring its own Ph.D. students upon graduation. By hiring its own students, an institution imports less of what is being investigated at other research institutions, and hires faculty members that are heavily dependent on their senior colleagues and therefore, less independent. Furthermore, when hiring its own Ph.D. students is possible for a research institution, there is a bias towards doing so since the institution's leadership tends to believe their own students are the best, even if this is not the case. A common practice of top research institutions in economics and management is then to have a policy stating that they never hire their own Ph.D. students immediately following completion of the degree.

The panel was told that offering a faculty position to existing teaching assistants upon completion of their Ph.D. is a “legal” requirement. Given that most students end up being teaching assistants in the schools in which they take a Ph.D. program, this automatically results in a substantial amount of inbreeding. The panel found the degree of inbreeding in the ten research units being evaluated to be substantial, with the resulting negative effects.

This is also specially important because several research units are currently involved in running Ph.D. programs and are likely to grow through hiring their own students. This is a very serious problem and the research units may want to re-think their strategies regarding

involvement in the running of doctoral programs unless they are able to create, even if informally, some arrangement whereby they never hire their own students immediately following completion of the Ph.D. One research unit seemed to have already made some progress on this front.

In relation to this point, and even though some doctoral programs seem to be well organized, it is not clear that the researchers being trained end up being of world-class quality given that they are not being trained by researchers who have proven world-class research standards. This gives further credence to the idea that the research units may want to re-think their strategies regarding their doctoral programs and the hiring of their own students.

Finally, in several research units, there was a high concentration of researchers with a doctoral degree from a given, middle-ranked Ph.D. program. This also creates problems in terms of breadth of knowledge within the unit.

5. Incentives for Research

Because of the inability to observe how academics use their research time, the existence of good incentives for research is crucial to obtaining a good research output. In the ten units being visited, the panel found that the incentives are generally poor. As always, there is some variability across research units in terms of both intentions and implementation. It should also be noted that these poor incentives seem to be due, in major part, to constraints outside the research units' control. Nonetheless, the units that have been more creative in terms of the incentive structure also have better research productivity.

As stated above, the lack of flexibility in compensation severely limits the ability to compensate the most productive researchers. This gives little incentive for the researchers to dedicate effort in research projects, in comparison, for example, to consulting. One unit (Inova) stated the intention to use funds from an endowment to give incentives to the most productive researchers. Other units may want to follow a similar approach, trying to find creative ways to offer compensation incentives.

Teaching loads were rather homogenous within each research unit, with little variation related to research output. Given compensation constraints for differentiating among researchers, the research units could try to influence the associated university departments to use teaching loads to give these incentives. We found some variability in teaching loads across research units, with the most productive units having, for the most part, lower teaching loads. This could ultimately serve as a system-wide incentive scheme. However, this system-wide effect would be seriously dampened by the apparent lack of mobility of researchers across units.

The criteria being used for academic promotions are another important aspect of research incentives. Given our observations of the practice over the last three years and of the junior faculty's expectations, research output in major international journals does not play a sufficiently important role in promotion decisions. An insufficient premium seems to be put on publishing in the most competitive international journals so that junior faculty members are unwilling to take risks and try for quality of publication instead of just quantity. Service and institutional development seems also to play a crucial role in the promotion of junior

faculty at the expense of their spending more time in their research endeavors early in their careers.

Given the composition of the research units and the recent productivity record of the more senior researchers, the panel also has concerns about the actual criteria being used in future promotions, despite any good intentions. Mixed signals are being sent to the junior faculty both in what they are led to believe the criteria are and in the perceived behavior of role models. Adjusting criteria for promotion will be a slow and painful process, but a necessary one if international research standards are to be achieved.

The system of up-or-out, which gives great incentives to the young researchers and creates a commitment on the part of universities to only keep the most productive researchers, does not seem to be in full-scale use in any university connected with the research units we visited. Some research units stated that the system is being implemented in their universities with not fully consistent results to date, and only a few cases in which junior faculty had actually moved to another institution.

Finally, several of the units being evaluated seem to include a relatively large number of senior researchers who do not have much recent research productivity and who, in practice, are important decision-makers in terms of the allocation of resources. Streamlined organizations with knowledgeable and productive decision-makers are quite important in terms of imparting correct incentives in any research institution.

6. Collaboration among research units

In the ten research units being visited, the panel found little research collaboration among units in close geographic proximity. There are some seminars being given in units by researchers from other units, but the panel found surprisingly little co-authorship work. More openness and less rivalry among the different units in Portugal should lead to fruitful research opportunities and a more active research environment. It should also lead to a greater exchange of faculty across schools and a more active academic job market.

7. Research productivity

If the research being done in the ten units visited by the panel is representative of the research being done in Portugal, it is not as significant as in other European countries of similar size. Having said this, the panel could sense some recent progress. In some units there is a clear understanding of what constitutes worthy research and the objective of doing more. As stated above, it is also clear that research units are under external constraints that seriously hinder their ability to produce high quality research.

Some research units are already producing work in reputable journals, but their researchers need to be more ambitious and aim for top journals, where their work will have greater recognition and greater impact. This will also affect the depth of their work positively, as they realize that a submission to a top journal will not result in a publication unless it contains serious and rigorous research.

Among the ten units being visited, Inova is clearly the most productive with several papers in well-known journals and a few in top specialized journals. This should yield some

international visibility and reputation for Inova. However, in all the units we visited, the panel did not find a single publication in a leading general economics journal. Similarly, one could possibly argue that the most competitive specialized journals in economics were not represented in the publications of the ten units over the three-year evaluation period. In these units, the areas of economics where there has been greater quality of production are general equilibrium theory and theoretical econometrics. There has also been some significant work in industrial economics.

The research output in management for the ten units was smaller overall than in economics, with operations research being the management area where there is greater productivity. Other areas in management such as finance, marketing, organization behavior, and strategy were covered very occasionally, and in lesser publishing outlets.

Other valuable research-related activities such as workshops, connections with prominent foreign research institutions, the organization of Ph.D. programs, the employment of post-doctoral researchers, and the organization of conferences have been realized with some degree of variability across the different research units. Again more of these activities occur in the units with greater research output.

8. General Recommendations

The general recommendations from the panel follow from the issues raised above. The panel understands that some of these recommendations are outside the control of the research units and even outside the control of FCT. We see them, however, as essential to the creation of conditions under which the potential of the researchers in the Portuguese research units in economics and management can be fully realized.

First, the research units should have a common understanding of what is excellence in research at the international level. FCT may help here by providing even clearer guidelines. In fact, it might be worthwhile to consider creating a list of journals ranked by degrees of international reputation. Several lists of this type are readily available from different sources and are all very similar. Even though this may not be an ideal way to evaluate exceptional contributions, it may be useful to help standardize publication goals among researchers and to reinforce research values. Several European countries with greater research productivity than in Portugal have chosen this option with excellent results along these lines.

Second, several constraints on the research units may be relaxed without further use of resources while creating much better incentives for research. These involve, in particular, flexibility of compensation and of teaching loads as a way to free time for and give incentives to the most productive researchers. In the same spirit, but harder to implement, would be a consistent policy of up-or-out that would keep only the most productive researchers in the research units. Several of the units being visited are already implementing some of these proposals to various degrees.

Third, one serious and potential danger in almost all units being visited is the possibility of growth through inbreeding – the research units hiring their own Ph.D. students. Unfortunately, this is a situation in which each unit does not gain much from unilaterally stopping the inbreeding. However, a general policy from above regarding this issue would

work wonders for all units, allowing them to grow by hiring the best possible researchers in the market, bringing with them new knowledge into each unit. This would also give the right incentives for the different units in terms of their investment in Ph.D. programs and for the exchange of ideas and faculty between the different Portuguese research units.

Fourth, the continuation of the support by FCT along with serious research evaluations is important given that in several research units this is the major form of incoming funds for research purposes. The units need good support in terms of library resources, computer equipment and software, travel expenses to conferences and for seminar speakers, post-doctoral support, and other suitable forms of support. FCT may also want to invest in improvements in the inter-university internet system in order to increase the speed and reliability of access by Portuguese researchers to this valuable tool. Additional compensation for the most productive researchers also seems to be needed, but the panel understands that this may be an issue beyond the control of FCT.

9. Conclusion

This evaluation showed that some of the ten research units have made good progress in the last few years and have a potential for improvement in the next few years. Changes towards common values in research, incentives for the most productive researchers, and stopping potential inbreeding would have a major impact on total research output.

The Ministry of Science and Technology should be commended for undertaking a serious evaluation of these research units. The exercise in itself generates incentives for research productivity.

APPENDIX

Research Units Being Evaluated in 1999 in Economics and Management

- Unidade de Investigação em Desenvolvimento Empresarial – UNIDE (Instituto de Ciências do Trabalho e da Empresa – ISCTE)
- Centro de Gestão do Instituto Superior Técnico – CEG-IST (Universidade Técnica de Lisboa Instituto Superior Técnico – IST)
- Centro de Investigação de Desenvolvimento e Economia Regional – CIDER (Universidade do Algarve)
- Centro de Estudos de Economia Europeia e Internacional – CEDIN (Universidade Técnica de Lisboa Instituto Superior de Economia e Gestão – ISEG)
- Centro de Estudos sobre África e do Desenvolvimento – CESA (Universidade Técnica de Lisboa Instituto Superior de Economia e Gestão – ISEG)
- Grupo de Estudos Monetários e Financeiros – GEMF (Universidade de Coimbra Faculdade de Economia)
- Centro de Estudos em Economia e Gestão – CEEG (Universidade do Minho)
- Gestão e Engenharia Industrial – GEIN (Universidade do Porto Faculdade de Engenharia – IDMEC)
- Centro de Estudos Macroeconómicos e Previsão – CEMPRE (Univ. do Porto Fac. de Economia)
- INOVA – Economia (Universidade Nova de Lisboa Faculdade de Economia)

5.2 SOCIOLOGY, ANTHROPOLOGY, DEMOGRAPHY AND GEOGRAPHY / SOCIOLOGIA, ANTROPOLOGIA, DEMOGRAFIA E GEOGRAFIA

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I. General Comments about our evaluations

1. As it is shown in the evaluation documents per center, we were impressed by the quality of the research undertaken by the various centers, taken as a whole. (I have to mention that I did not communicate the results of the former evaluation to the members of this panel before the final discussion between us; so they had no apriorism).

We have confirmed the "excellence" of two centers (Centro de Estudos Sociais (136), Coïmbra, and Instituto de Ciencias Sociais (232), Lisboa) and we have upgraded one from "very good" to "excellent" (Centro de Estudos Geograficos (295), Lisboa). This evaluation refers to

- (a) the quality of the research, which, in particular, is characterized by its concern for cumulativity and for theorisation;
- (b) the effective and active implication of all members of these centers and the efforts made to exchange ideas, and to act as reciprocal constructive critics;
- (c) the quality of their publications - books and articles;

- (d) their effective links with foreign researchers and their participation in international networks, seminars, conferences, ...;
- (e) the support they give to post-graduate students - which appears in co-publications, theses, but also in the efforts made to introduce these students in national and international networks;
- (f) the effectiveness and flexibility of the organisational structure;

I would add that we were impressed by the entrepreneurial spirit of these centers, by the part every member plays to accept challenges, by the fact that they have a clear project and manifest dynamism.

Another center confirms its former evaluation "very good" : the Centro de Estudos das Migrações e das Relações Interculturais (289), Lisboa. The main difference between this Center and the "excellent" ones is that it seems to lack a strong integration : its members do very interesting research but they seem not to have intensive exchanges between them and it does not appear that it has a very coherent project. But the work done is very good, the quality of the publications is generally impressive, most of the members participate in national and international projects and networks, ...

We have upgraded one center from "fair" to "good" : the Centro des Estudos Geograficos (247) in Coïmbra. And we consider that the difference between "very good" and "good" is a very significative one. In this last case, the performances regarding many of the criteria we took into account to evaluate three centers as "excellent" appear also present but this center lacks of real dynamism, entrepreneurial perspective and effective internal and external cooperation.

Four centers were evaluated as "fair" (and here too, the difference with the superior grades is very sensitive) : one centre which got already this quotation (Centro de Tradicoes populares portuguesas (298), Lisboa) and three which were before evaluated as good and thus were downgraded by us : (Centro de Investigação em Antropologia (283), Coïmbra; Centro de Investigação e Desenvolvimento em Ciencias Humanas e Sociais (57), Evora; Centro de Estudos de Geografia e Planeamento Regional (161), Lisboa). In addition to the criticisms we have expressed concerning the centers evaluated "good", we consider that these centers - even if some of their members might merit a better evaluation - have little internal coherence (and although conflicts are known by the members (57), they seem unable to solve and to overcome them); that there is no real programme concerning the post-graduate students and no or very few scientific internal and external contacts; and that the results of the researches are relatively limited.

I would like to make a specific remark concerning one of these four centers, the Centro de Tradicoes populares portuguesas (298), Lisboa. Despite the interest of its work and the importance of the material they collect, this center is still functioning on a very old-fashioned way, as a "craft or cottage industry", resting on good will of its members and seemingly unable to transcend a parochial interest. But it is also important to underscore that some younger members try to re-orient the researches and to situate them in a more "universal" and theoretical perspective; their efforts are nevertheless relatively desperate

because they work alone ... and they do not appear to see the real importance of outside relationships or practically they do not have the possibility to develop such connexions.

Finally, we gave the quotation "poor" to two centers : one (Gabinete de Estudos de Desenvolvimento e Ordenamento do Territorio (294), Porto) which had received "good" at the former evaluation and one (Centro de Investigação em Ciências Sociais e Aplicados (286), Lisboa), which was considered as "very good" by the former evaluators. We had very serious, long and very conscientious discussions about these two centers (and, only for these two ones, I gave to my colleagues the information concerning their former evaluation during our debates). Despite the same level they received, and despite the fact that we evaluate both of them relatively negatively on each of the criteria mentioned here above, each of these centers offered us different reasons which confirmed us in this regrettable impression.

The responsible and the members of the center 294 (Porto) were completely unprepared for our visit; they did not know - and they said it - what we were doing there and what was expected from them. They answered our questions with difficulties and reluctance; some showed signs of exasperation, telling that they were too often evaluated and that it had no sense; ... We naturally had no personal problems with that ! But it was for us an indication of their conception of scientific work and of the challenges this supposes ...

The problem of the other center (286, Lisboa) is very different and still make us feel relatively ill at ease. Indeed, it is only when we were in Portugal (and very late during this week which was an extremely busy one) that we received the documents concerning this center; so we did not have the possibility to examine in advance these documents carefully and we were not well prepared for this meeting. Secondly, we met only a few members of this center and most of those we saw were specialized in other disciplines than ours. Nevertheless, we got the impression that, even if interesting people are working there, the center lacks real leadership and internal cohesion. But we were confronted with a group very difficult to evaluate, the dynamics of the exchange being not very effective.

2. The different centers we have met are relatively heterogeneous - what induces some difficulties for a comparative evaluation - but, more dramatically, some are internally very heterogeneous - what makes that it is difficult to speak about "a center" : some of them are composed by so independant sub-groups that they have no contact or only occasional and/or administrative ones between them and they do not know why they are located in that particular center. The artificial and maybe purely administrative composition of some centers is certainly an error which induces counter-performances from a scientific point of view but also as far as the relations between the researchers are concerned.
3. Sociology is a relatively new academic field in Portugal. So it is fully understandable that many researchers are still working on their PHD. Furthermore, as Portugal tries out very fundamental and very quick changes since a few years, it is evident that there is an important need for studies on these changes and on the effects they have; that will say that there is a need of researchers in this scientific discipline. And that probably induces an increase of people engaged in a PHD. But if we consider the large number of

postgraduate students who are working in most of the centers we evaluated, some remarks should be made.

- (a) Some senior researchers have too many post-graduate students to supervise. That may handicap their own research and sometimes it may also handicap the supervision itself because these senior researchers have not enough time to really supervise these students.
- (b) That might be an imperative reason to develop "doctoral schools", with regular meetings during which PHD students, might present their own research, be confronted with each other and with researchers coming from outside. This will also help them from a theoretical and methodological point of view.
- (c) In different centers, a more or less important part of the research rests on PHD's. That creates sometimes too much dispersion and prevent these centers to define their own strong research lines, on which they would be able to become particularly competent and to be internationally highly competitive.

II. Comments about the Evaluation Procedure

1. As I have said, we have experienced some difficulties as far as the composition of some centers is concerned : they are very heterogeneous from a disciplinary point of view. It is for instance the case with Unit 283, "Centro de Investigação em Antropologia" (Coimbra) and with Unit 286 "Centro do Investigação em Ciências Sociais e Aplicadas" (Lisboa). It was very difficult to evaluate such centers because (a) we were not at all competent in some disciplines which are very important in these teams; (b) the performances of the different subgroups were sometimes very different - which has an impact on the general appreciation. Sometimes, we had also the impression - confirmed in certain cases - that the centers were constituted "ad hoc", just to try to enter into the criteria defined by the FCT (dimension of the team, ...)
2. The criteria proposed in the guidelines to be used by the centers as well as by the evaluators (in particular the "rating scales and criteria") appeared not always to fit very well the disciplines we had to evaluate - i.e. Anthropology, Sociology, Demography and Geography. The grids appear to have been conceived essentially in referecne to the so-called "exact sciences".
3. An important aspect, in relation with this second point, concerns the language used in the publications. It is certainly important to have publications not only in Portuguese but also in other languages and, in particular, in English, to ensure international diffusion and cooperations. But some remarks should be made in relation to that.
 - (a) There is already internationalisation for portuguese researchers when they work with people from and on topics concerning countries of Portuguese language, such as Brasil, or different African countries (PALOP). And we had the feeling that this is not sufficiently taken into account.
 - (b) Many researchers we have met are engaged in research concerning Portugal itself - and this is indeed very important because of the important changes the country is

confronted with since some years. In these cases, it is naturally normal that their work is done and written in Portuguese because it responds to a practical expectation and use. I have nevertheless to add that it would be interesting if the results of such investigations could be summarized and more theorized and presented in a more international language to produce exchanges and possibilities of critical and comparative debates.

(c) The language is part of the object of our disciplines. If it is maybe without big incidence to homogenize the language in mathematics, physics, chemistry, engineering, even in pharmacy and medicine, where one may say that the object is constant and transcultural, it is not the case for the human sciences, where language is an essential part of culture, of relationships but also of power and of world vision. Language determines the categories of our thinking; it also determines what is or is not possible to think. It evolves in reference to what is directly experienced. The language of the country (with its regional and social variations that we call "dialects" and "sociolects") is a central component of the phenomena we have to observe and to analyze. So it is normal that a large number of publications are using the language of the country. But, once again, it would be interesting to produce summaries and theoretical and/or methodological synthesis to promote and to enlarge international exchanges.

(d) To have a "lingua franca" - english - is certainly interesting to permit, to facilitate and to enhance communication. But non-native English speakers and above all writers have difficulties to speak and especially to write with all the nuances and sophistication they would be able to do in using their own language. And there are also things which are not perfectly translatable because they express specificities of a particular culture and of a particular history. Furthermore, if non-native English researchers have to publish in English, they will very often need the help of a professional translator - which would represent a considerable amount of money in their budget.

4. The interest of the site visits is not always evident and it varies from center to center. Certainly, it allows to evaluate directly the importance, the quality, and the adequacy of resources for the research activities (facilities, library, equipment, technical and secretarial support); from this point of view it is certainly interesting, even if it is not as important as it is for other disciplines which need laboratoria, heavy material, ... And it gives also some indications concerning the "ambiance" in which the people have to work (Even if, in some cases, people have said they work essentially at home - which is not necessarily due to a lack of space in the center - and that they come only once or twice a week - sometimes less - for a meeting or to check their mail (and that is less and less vital since all of them have e-mail connections at home).

Probably one of the most interesting aspect of these visits to the site for us was to see who was present (only the "staff", the staff with one or two representatives of the personal or everyone) and how (with or without preparation, with documents and slides, with or without a clear and organized presentation of activities, with or without the capacity to point out their most important aspects and specificities; ...) and by whom (by the leader only, by those responsables for the different fields, without any

kind of prerogative; ...) the presentation was done. The difference between the well prepared and cleverly orchestrated presentations made by the more excellent and professional centres, and the amateur, haphazardous even confused not to say contradictory representations of the weaker centres, made one wonder whether they had all been made equally aware of what was at stake and what was formally expected of them. But the fact that it was generally the best centres which presented themselves in the best manner is certainly also an interesting information.

All these variations gave us interesting indications of the way the centers are functioning.

5. A difficulty we met is due to the fact that we had only to evaluate research when many researchers are also professors and that it is not always easy to separate the two kinds of activity. The evaluation sheets moreover are sometimes mixing both because they contain questions about the "supervising of post-graduate students and training of younger researchers" and about the "organization of advanced training seminars". It is naturally clear that there is a link between these last activities and personal and/or team research but there is also a kind of competition between these as far as available time is concerned.

Many researchers are also teaching and training not only post-graduates students but also graduate students - what is very time-consuming, most of all for the younger colleagues who have to prepare their lectures and the pedagogic material. The chances to pursue research are fundamentally different according to whether it is done in addition to teaching and other pursuits or entirely in and for itself : how is it possible to compare equitably an Oxford Don who at the most only has to give 8 lectures a year, who has immense bibliographical material at his immediate disposition, whose academic year begins towards the end of October etc. with a far less privileged colleague who has a heavy teaching load, who has to travel far and wide in search of empirical material and documentation, and whose academic year begins mid-August ? Before evaluating research the very conditions in which it is done should be explicitly known.

6. The distinction between fundamental and applied research is not as easy in our disciplines as it is in some other sciences.
 - (a) Indeed, we don't work in laboratories - that is, in a certain sense, artificially and theoretically. We have to start with life itself, with what we can observe and analyze. So we have to begin with concrete things, facts, events and it is only in a second moment that we may begin the distancing and generalization.
 - (b) More fundamentally we work on human everyday life and, generally, (notably because it is only for this that we may get money !) on topics which are considered as problematic in a certain country at a certain time. So there is most often a very practical expectation towards our work.
 - (c) This does not mean that there is no "fundamental" aspect in our research, on the contrary : when we theorize from various concrete experiences, when we try to improve our concepts or when we propose new paradigms; when we go from

empiric observations to the construction of concepts and theories, what afterwards makes possible the application of the last one to very diverse empirical facts and permits to foresee, which is not to predict or to simply extrapolate.

Applied and fundamental research appear then to be intertwined : the first bring material for a permanent falsification of theoretical and abstract conceptualisations and these last ones authorize anticipative hypotheses and interpretative elaborations, they indicate the kind of informations to test anew in further investigations; doing so, it opens the way for cumulative research rather than to an easy acceptance of dispersed investigations. What seems to be essential is indeed the cumulative dimension of our research, the progressive overhangs that our confrontation with the field make possible, the permanent challenge of the validity of existing statements of "truth".

III. A few very practical aspects :

1. It would have been useful to have had in advance not merely a list of publications but also samples (small but significant) of
 - (a) high(est) level publications - in international reviews and
 - (b) ground breaking or innovative articles or papers which by their tentative or eccentric nature would (not yet nor perhaps ever) make it to the more sober, serious, scientific review. The choice of these papers would be up to the members of the centre themselves; for the evaluators, that would be an interesting information: what do they consider as remarkable in their production?
2. Participation in colloquia or scientific meetings - which is a question members have to answer - is not in itself a sufficient information. No more than to enumerate people from other national and international universities and institutions with whom one has connections. The long lists of such participations and so-called networks people and centers sometimes produce say nothing about the quality and the importance of these ones nor about the perdurance and the scientific seriousness of these links. We know that to be able to get money to assist in a colloquium, one needs to propose a paper and to get it accepted by the organizers; and we know that consequently, many papers are produced as an administrative formality. Additionally to the (too) long lists produced - or even instead of them - it would be better to receive more qualitative informations : e.g. will the presented paper be published or has it marked the beginning of a relationship with other researchers ? What are the concrete results of the networks of research ? ...
3. The informations given in the material we receive in advance appear in general to be more quantitative than qualitative. Notably, the pressure "to publish or to perish" appears clearly. It is also very often redundant. Generally, no selection is made, trying to point out the particularities of the centers, their innovative contributions; everything is put on the same level. Why not ask them
 - (a) to prepare a more succinct report of the work of the center ? We have to evaluate centers and not individuals and we receive a lot of personal informations which are

not very relevant for the task of the evaluators (the more detailed informations might naturally be given in annex but not in the main corpus)

- (b) to illustrate this report by some concrete material to be chosen - as it is said before - by the members themselves : what do they consider as the most representative productions of their center ? Naturally, this may induce internal tensions : articles and books of whom ? whose networks ? But their capacity to overcome this difficulty or to tell that there was not an agreement on the choices would also be an indicator of the functioning of the group and of its scientific maturity
- (c) to manifest a constructive critical awareness of the process of evaluation itself : people "fill" the documents they receive relatively mechanically and without real discussion; they try to encounter what they suppose to be the expectations of the Foundation and of the evaluators. Why not ask them to produce themselves constructive arguments concerning their functioning, their problems, their efforts? By doing so, they would also find themselves less in front of a tribunal, with all the anguish this supposes and we really feel that in different centers it was perceived as such.

4. Concerning the work of the evaluators, two remarks have to be made :

- (a) it would be very important that the coordinator might have to time to compose his or her team. I received the proposal in June, i.e. the examination period, and I had to be ready with an international and interdisciplinary team whose members would be able to understand and speak english and french (because this last language was also often preferred by portuguese colleagues and I think we have to give them the choice; they are already obliged to speak a foreign language !) for the fall (mid-September to mid-October was the period propoed by FCT for the site visits) - that is to say just after the summer vacation. I have to say that this was not easy, it took me a lot of time and made it impossible to have a team composed with all my "first-choice" colleagues ...a better timing would also permit the team to have the center's reports much more in advance. I personnaly received them in July but the other members of the team got the documents only at the end of August or early September. That is too late and it might have handicaped the quality of their work : you never know what may happen in your professional or private life and with such a short time limit, you do not have the possibility to reorganize your timetable.

5.3 EDUCATIONAL RESEARCH CIÊNCIAS DA EDUCAÇÃO

Panel Coordinator:

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1.1. Setting up of the Panel

The Evaluation Panel in the area of Education Sciences was composed of the following foreign professors:

André Gil Perez – University of Valencia,

Alejandro Tiana Ferrer – University of Madrid,

George Lerbet – University of Tours,

Paul Taylor – University of Rennes/Open University,

having as co-ordinator:

Maria Teresa Ambrósio – Universidade Nova de Lisboa,

who, jointly, have assured all the tasks of orientation, document analysis, visiting to the Units and drawing up of reports by unit as well as the Global Report.

In the setting up of this Panel, we took into consideration the diversity of the research areas developed within the Research Units under evaluation as well as the evaluators' knowledge on the status of the education research in Portugal.

1.2. Method

After reading the reports of the Research Units, and confronting them with evaluation criteria described by the General Co-ordinator for the Evaluation, the foreign evaluators prepared a set of methods appropriate to the visiting of the different units, in order to uniform such evaluation criteria and the drawing up of recommendations and final reports. Due to the diversity of the Research Units, we also had as an objective to proceed to a characterisation of the same, analysing them according to its institutional status, duration, academical seniority its researchers, its relation to other areas of science and its evolution in the last three years. After this, we aimed at identifying the Unit's Profile and Research thereof, concerning the activities of Human Resources Training, Scientific Production and international degree of the Unit. To such effect, we drew up the appropriate grids for characterising and hierarchising the centres, having in mind the criteria previously indicated by the General Co-ordination for the Evaluation and also the supplementary information gathered and presented by the researchers during the visits and its further analysis, duly considered according to each Centre's situation, for the purpose of recommendations.

For each Unit was drawn up an Analysis Report by each evaluator based on the Reports presented by the units.

Then, we carried out Evaluation Sessions to allow each team to express its abilities and trends, the search of self-organisation and identification lines, and to present the areas to which they are more oriented and interested to develop integrated projects and coherent programmes of research, that may be considered within the Programme Financing or other types of funds. We underline that the Directors of the visited Units showed a correct and sufficient information of the objectives of this evaluation programme and, therefore, they presented a clear report of the future guidelines of research and of the needs and difficulties of the respective Units.

1.3. Global Appreciation

After visiting and drawing up reports on each unit by the Evaluation Panel, we proceed to the Global Appreciation of the work, from which we stress out the following considerations.

Some of the evaluators already knew the centres under evaluation from previous visits thereof. They observe in all the centres that there was a quality improvement in the gathering and organisation of the information requested by the Foundation for Science and Technology, which is shown in the technical Reports analysed. According to the evaluators, such an improvement is due to a better information, knowledge and registration of data in the centres, as well as to a more careful management of projects and resources thereof.

The same quality improvement in the work organisation, its registration and management, was generally confirmed during the visits, by the way the work carried out was presented by the co-ordinators.

Therefore, within this scope, we can say that in the last three years the centres under evaluation showed, in general, a high degree of management ability and of growth focused on well identified areas. Furthermore, the contents of the Reports showed the result of the teamwork and of the self-evaluation, hence enabling the evaluation tasks.

However, and in all the centres, the growth, in terms of researchers with a doctor's degree, projects, financing and publication, does not correspond to and equal growth of research maturity, resources management and research potentials.

In fact, some centres and units under evaluation are presented as a sum up of teams, practically separated among them, with no cross-references, projects or researchers. Others, although in a smaller number, have tried new models of organisation to allow a bigger concentration of resources and financial efforts in the research lines, which revealed bigger potentials. Some others propose a future division into more homogeneous units or even the introduction of management criteria more rational and appropriate to the aimed objectives.

The dialogue between the research teams and the research panel has allowed the identification of the biggest difficulty – the Units do not always have well defined objectives and goals, that allow them to have a controlled strategy of growth, a criteria-based selection of projects with self financing, a support to publications and activities of dissemination and training justified on a priority basis.

Furthermore, the demand of the Foundation for Science and Technologies for the Units to select and present the “five best works” should be followed in the future by a justification demand, not only of the scientific contents thereof, but also of its dissemination, reason of publication in national or international revues. For the evaluators, having copies of such works would also give an interesting information for a better understanding of the Unit's work.

It was also noticed the effort of the units concerning the equipment of their facilities with computer and audio-visual means and the acquisition of bibliographies. Notwithstanding, it would be useful for the evaluators to ask to each Unit for a relation of the international revues that are deemed indispensable for their work and the way they usually access thereto.

Such demand would allow the identification of the Unit with the current trends of the area researched expressed within the International community. It would also allow the identification of the international degree of the work carried out by the team.

To justify the organisation lines and programmes of the Unit's work, the evaluators also deemed pertinent to demand in the Technical Report for a brief comment, but sufficiently justified, on the most interesting works published within the specific scientific areas by the researchers.

Also, the self-evaluation of the team on its path, on its history, assessing with quantity and quality criteria its path of scientific maturity and its growth, would make the effort of drawing the Evaluation Report more useful to the objectives aimed at with the evaluating process.

1.4. Final Recommendations and Considerations

1. Basic Financing

The level of basic financing in the Units under evaluation has grown considerably in these last three years, thanks to the basic financing allocated by the FCT and also to the external financing achieved through the projects.

However, all the Research Units fight with huge needs of junior researchers, since all its elements are extremely busy with activities of teaching and administrative work, their research work in the centres not being recognised by Schools and Universities thereof.

2. Programme Financing and Integrated Projects

Integrated Projects

Some of the visited Units also showed development potentials within fields of research that are deemed as priority for the Country. We recommend their support so that they may pass from a theoretical level, less profound and structured, scattered in individual researches, to the setting up of a coherent body of knowledge centred on specific and well-defined problems.

Therefore, we propose the conclusion of contracts, through the Programme Financing or the Integrated Projects, with some Units, individually or in network, that seem particularly prepared or oriented to several areas; we are also in favour of the maintenance of support to dedicated libraries of the Units as well as to the dissemination of results thereof.

Scholarships

The demands and recommendations for Programme Financing are seen mainly in the bind to the Units of researchers, passing or already having a doctor's degree, such bind lasting for fixed period of time by way of scholarships for the development of well- defined projects.

3. Support to international dissemination and publication

As recommended in the previous Report (1996), and due to difficulties of visibility, affirmation and recognition of the research work carried out by the Portuguese scientific community, we recommend the support to a new revue (luso/brasilian), or to some other(s)

already existing, in order to achieve the necessary level of exchange, co-operation and indexation with other recognised international revues.

4. Integrated programme of Research

Finally, the evaluation team, considering in general the current situation of the units under evaluation, deems useful to recommend to the Foundation for Science and Technology the establishment of an Integrated Programme of Research on Education, in two or three interesting problematic fields of research, to which the units may apply with projects, articulating their researchers' teams, whether in network or by several co-operation protocols. This would avoid the proliferation of small projects for the same areas, and would promote the existing human resources and materials, as well as the international co-operation and the crossing of the existing scientific knowledge, whether disciplinary or interdisciplinary.

Teresa Ambrósio

5.4 PSYCHOLOGY / PSICOLOGIA

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INTRODUCTION

The present Final Report has been written after discussion of the content at the end of the on site visits to all research centers in October 99, and has been submitted by E-mail to all members of the panel before being sent to FCT office. It aims at providing Portuguese psychologists with an external view on their achievements in research, which hopefully will help them in improving their records and in matching as extensively as possible international standards in their field.

Following the request by FCT, this Final Report is complementary to individual Units evaluations, and as such it is especially devoted to issues common to all research centers. It is hoped that the description and analysis of various features, the identification of some problems and difficulties, and the formulation of some advices and warnings will be useful not only to researchers themselves but to the academic institutions which house them as well as to whatever agencies which bring them support.

All research centers visited should be thanked for their collaboration in providing the panel with all the informations needed in order to produce a fair and sound evaluation, viewed as a constructive dialogue rather than a judgement.

GENERAL BACKGROUND

It seems appropriate to put this Report in perspective by reminding that, left aside a few exceptions, psychological research is recent in Portugal, as are recent the creation and the consolidation of full curricula in psychology in Portuguese universities (going back, in most favorable cases, to little more than 20 years). Achievements in research are of course

to be evaluated in that context, taking into account that psychologists responsible for developing the teaching of their science had to face simultaneously the demands of local society in terms of applications to specific fields (such as education, work, health, etc.), the concern with the professional preparation of their students, and the ambition to promote research as an essential aspect of higher education. They should not be blamed for having given priority to one or another of these goals. It can be argued, for example, that training professional psychologists to meet current demands of the community was initially more urgent than developing basic research, or that establishing links with institutions likely to employ psychologists was a prior condition for developing applied research.

Also, resources for psychological research have been scarce, until recent years, in which national agencies, especially FCT, have made remarkable efforts to increase such resources. However limited such support can be, psychologists should take it as a challenge to demonstrate their capacity to match the standards of psychological research at the international level. There is no doubt that many of them are really engaged in that direction.

In evaluating research in psychology, one is confronted with the problem of special time constraints in many areas of research - a problem common to other human sciences. For example, developmental studies using longitudinal methods imply observation and/or experimentation on the same subjects over several years; or, most researches carried out in normal life environments - be it work context, educational institutions, health care agencies, etc. - require that good relations between people in charge of such institutions and researchers be previously established. Time constraints cannot be avoided, and it can be expected that results cannot possibly be produced as quickly as from laboratory experiments carried out over short periods of time, with all variables, including subjects availability, under the experimenters' control. In this respect, a typical example in modern psychology is the contrast, in addressing the same problem - let us say memory or language processes - in cognitive psychology using normal adult subjects in the laboratory and in neuropsychology, studying brain damaged patients in the hospital. Awareness of such constraints is crucial in any fair evaluation of psychological research.

NOTE ON THE PRESENTATION OF REPORTS BY UNITS

Although very informative in many respects, the presentation of the reports, as requested by FCT, makes for redundancies: for example, publications appear in various places. These redundancies could be reduced and give place to informations of a more substantial nature, especially concerning main outcomes of research already carried out and more technical details on projects. Both of these are often phrased in somewhat general terms, providing the reader with the widely defined framework rather than with the technical specificity of the research done or projected. In some cases, the reports tell more about intentions than actions.

It seems that the interpretation of instructions for filling the report form varies from unit to unit. For example, some do list in individual CV's the complete list of MA or Ph.D. students under supervision, while others do limit themselves to mentioning those students who have completed their degree within the last three years. Authors of the report and

members of the unit providing them with informations should be requested to comply strictly with instructions, using well structured forms for all basic factual data. This would make reading and comparison of reports easier.

Although the evaluation bears essentially on the scientific quality of research, it can be very informative to know what the research groups have been doing with the money received, not in terms of detailed accounting report, but in terms of priorities given to specific needs of the research carried out.

COMMON ISSUES TO ALL UNITS

Although affecting in various degrees the seven units considered, some features and problems are common to all of them.

1. Overall evaluation of the units is extremely difficult because they are composed of very heterogeneous subgroups, and of a wide range of individuals working in very different areas, sometimes difficult to conciliate, and to which common criteria are difficult to apply. There is a feeling of being unfair to those better subgroups or individuals if they are to be evaluated globally with the rest of the unit. If the large unit structures might have made sense originally, it is time to sort out those groups which are really good and have them supported as such, and leave out those which do not really match the level expected from research funded by a national agency such as FCT. In the long run, it would not be fair to the good groups that groups with lower quality would benefit from their work. Especially promising individuals or subgroups are easily identified in Units Evaluation reports. At this stage, the evaluation Committee has not thought it appropriate to propose such discriminative treatment, but only to call the attention of FCT on the issue, recommending a change of policy in this respect by the end of the next period of evaluation, and to warn members of the various units of such possible change of policy. It seems advisable to go beyond the early stage in which almost every member of the teaching staff would almost automatically be a member of a research unit, and to reach a stage where only those who are really contributing very good research would be eligible for renewed funding. This would result, of course, in defining smaller, thematically more focussed units, closer to the present concept of "line" - or even of area within a line - than to the present units.

2. Unit 166 (Center for educational and psychological research at the Institute for Psychology and Education, University of Minho, Braga) deserves special comments and recommendations in this respect. It is still composed of both psychologists and people in the field of education. This results from a historical situation, and reflects initial emphasis on educational applications of psychology. Although it does not seem to be a source of conflicts among members of the unit, and does not seriously affect the efficient management of it, this situation is obviously at odds with the structure found in other universities, where educational sciences and psychology have eventually developed as distinct research units, which by no means hinders collaborations when desirable. That state of affairs has been recognized by FCT when it decided to have different panels evaluate the two fields separately. In the case of Unit 166, the two panels, i.e. psychology and education, were programmed to join in the evaluation visit. However, both coordinators

agreed, after a short common session, to operate separately and to provide separate evaluation report.

Given the present rules of projects evaluation and of research achievements evaluation procedures, given the present excessive size of the unit composed as it is of people both in education and psychology, given the specificity and in most cases the lack of relations of research carried out in one and the other field, the Psychology Panel strongly recommend that the Line corresponding to Psychological Research within the unit be converted to an autonomous Unit. It would benefit both psychologists and education specialists, at all stages of the research activities. The Psychology Panel is confident that the Education Panel would share this view, and if so, would recommend to take, without delay, the steps towards the proposed change.

3. There has been a tremendous effort in developing MA and Ph.D. training, which is certainly one of the most positive aspects of the last triennial period. However, one should be aware of the often denounced tendency of Portuguese Faculties to inbreeding. In order to compensate for that, offers of masters training and Ph.D. programs should include some requisite for minimal training in another university, if possible abroad. And even when good programs are available at the student's home university, candidates to Ph.D. should be encouraged to visit and study in other places.

4. There is an overall commitment to develop research relevant to the community's demands, and to contribute significantly to applied fields. Units should be praised for such emphasis, which meets legitimate expectations from society. Besides classical, well established fields, such as psychological assessment or educational psychology, initiatives in more recent fields, such as sport psychology, neuropsychology, road safety, health psychology, are very promising and should be encouraged.

5. It is surprising that, in many cases, Ph.Ds. achieved in 96-97 have not been turned to publication, be it in full version or as articles in international journals. Does that reflect that the format and style of theses are inappropriate for quick publication, or that average quality does not meet publication standards, or that Ph.D.s suffer post-doc depression?

6. Some units rated as "excellent" in the last evaluation (1996) might resent being rated "very good". The main reason is the level of publications, explicitly emphasized among criteria for evaluators. On the whole, the units have not really met the standards of excellence in international publications. This is not to say that some groups or individuals have not reached in this respect excellence level: knowing the criteria applied, they will easily identify themselves; the others will do as well, and will hopefully be stimulated to meet the criteria within the next evaluation period.

7. This important issue of publication in internationally recognized journals should be considered in the context of general publication policy in most units, which calls for some specific remarks. Although already stated in some panel reports on individual units, it seems appropriate to reproduce them in the present final report, since they apply to the majority of units, whose members publish a substantial proportion (from 25 to 65%) of their papers in the home run journal.

Aspiring academic institutions often decide to begin to publish their own periodicals. The reasons for such decisions are often quite understandable:

- A periodical produced by a university's faculty/institute provides national and maybe international visibility;
- Such "in-house" periodicals offer a publication outlet to young members of the institution;
- Usually the majority of the editorial boards of such periodicals come from that university, thus senior staff may receive additional visibility.

However, there are dangers of such strategies which may back-fire:

- A multitude of such periodicals within a country will soon lead to a dearth of submissions, there simply is not enough research around in one country and discipline;
- In consequence in order to keep the journal afloat, the editorial policy will tend to lower standards and favor submissions from members of the home institution. These submissions alone may keep it alive, outsiders will become hesitant to submit papers.
- Publications in one's home journal will often be considered "favorite-sons-publications", their value is considered to be below publications in other national periodicals;
- Especially younger staff members, who may get used to easily publish in their home university periodical, will remain protected from the true natural and international level of competence expectations, because they do not get respective feedback. In consequence: they become complacent and ignorant of true competition.
- End result: inferior national quality of research publications.

There is of course no intention here to discourage from keeping such local publications alive. However, research centers and editorial boards should be warned of possible counterproductive effects, especially in terms of international publications. Also, in the long run, such periodicals might gain higher level and international visibility by merging into a more limited number of titles, and by making efforts to make them attractive channels of publication for reputed foreign scientists. Research already carried out in cooperation with research centers abroad would seem to provide the opportunity both for attracting papers (co)authored by foreign researchers and for favoring international publication of papers (co)authored by Portuguese coworkers.

8. Up to now, the main concern of the research Units has been to consolidate themselves in their respective institutions. Promising international cooperations have been engaged, which hopefully will be extended in the future. There has been occasional cooperations at the national level. However, it seems that these cooperations between Portuguese institutions should be systematically developed to the general benefit. Some subgroups, in different centers, obviously share similar scientific interests, and there is no doubt that they would be more productive if they would cooperate, perhaps first through the

organization of joint seminars or workshops, then by elaborating joint research projects, building upon their complementary expertise and resources. Eventually, their cooperation might result in the creation of interuniversity research centers, which would provide stronger structures for internationally competing research in specific areas.

CONCLUSIONS

On the whole, psychological research in the visited centers, young as they are, seems on the good tracks. It covers an array of areas, some of which have been only recently added to more classical ones. There is a general emphasis on applied fields rather than on basic research, a feature that is linked with the concern for meeting the demands of the community. Efforts to train MA and Ph.D. students have been successful and will contribute to future development of research.

Publication policy is one major concern of the present panel: more attention should be given by most individual members of the units to reach the international standards usually required as criterion of excellence. Faculties and research centers should seriously think about the best conditions to help them reach such goal, especially with respect to the widespread development of local journals.

The second main point of concern is the heterogeneity of most units, in terms of quality of subgroups as well as in terms of excessive variety of scientific areas covered. The panel strongly recommends a progressive (indeed in one case a rapid) move to better-focussed smaller units. Such a move would not lead to their isolation if, at the same time, teams working on the same areas but belonging to different universities develop mutual knowledge and engage in productive collaboration.

Marc Richelle

5.5 LINGUISTICS AND COMMUNICATION / CIÊNCIAS DA LINGUAGEM

Panel Coordinator:

Mats Rooth

Universitat Stuttgart, DE

Evaluation Panel:

Anthony Kroch

University of Pennsylvania, USA

Charlotte Galves

University of Campinas, BR

Eduardo Raposo

University of Santa Barbara, California, USA

The panel in linguistics reviewed six research units: Centro de Estudos de Linguística Geral e Aplicada (CELGA), Centro de Línguas e Culturas da Universidade de Aveiro (CLCUA), Centro de Linguística da Universidade do Porto (CLUP), Centro de Linguística da Universidade Nova de Lisboa (CLUNL), Centro de Linguística da Universidade de Lisboa (CLUL), Instituto de Linguística Teórica e Computacional (ILTEC). The first five do research in core areas of linguistics. At CLUNL and especially at CLUL work in linguistic resources, corpora, and/or data-oriented methodologies is prominent. ILTEC does research in computational linguistics.

The panel consisted of Eduardo Raposo (University of California at Santa Barbara), Charlotte Galves (University of Campinas), Anthony Kroch (University of Pennsylvania), and myself. We read written material submitted by the units, conducted half-day site visits, and discussed specific and general issues among ourselves.

In core areas of linguistics, research at a good international level is being done in Portugal. Researchers are well versed in current theoretical perspectives and methodologies, and substantial work on the Portuguese language is being done in all subdisciplines. In general, the international impact of the research is not what it could be, because of limited dissemination of results in international journals. However, in some specific areas international publications and integration into international research networks are good.

In computational linguistics, good work is being done in some areas, but in general there is evidence of insufficient recruitment of young PhD researchers. People with computational

backgrounds are entering the field in project positions below the PhD level, and it can be hoped that the situation will improve in coming years.

The panel did not review computational linguistic research in computer science institutes, and therefore did not obtain a complete picture of the structure of research in this area. There are numerous collaborations between linguistics units and computer science or engineering ones. But in many cases, insufficient computational expertise is being brought to bear in the linguistics institutes. Laboratory facilities, including computer networks and hardware, are weak at CLUL and CLUNL given the research being undertaken. Despite these problems, novel computational and data-oriented research lines in the linguistics institutes are exciting.

The sections below discuss three issues, which the panel focused on during site visits.

International dissemination of research

The evaluation materials provided to us by the FCT (which are publicly available) stress an international standard of excellence. In particular, publication in the best international journals (perhaps the ten or twenty top journals in the field) constitutes the highest level of excellence in publications. This standard was met only in a few specific subfields and by a few specific researchers.

In discussions during the site visits, the question was raised whether such criteria could sensibly be applied in areas such as historical linguistics and dialectology, and in other research specifically concerned with the Portuguese language. However, Portuguese is a major international language, linguistics is a highly international field, and work on Romance languages has a prominent place in major linguistic journals.

While linguists in Portugal are in a much better position than members of the panel to think about such issues, it seemed to us that a great deal of progress could be made in the area of international dissemination of research. Joint editorial activity with linguists in Brazil is surprisingly limited. It appears that there is no journal concerned with Portuguese linguistics with a truly international editorial board and international profile. This problem could be remedied by the expansion of the editorial boards of existing journals or by the establishment of a new journal with an international profile.

Development of young researchers

At each institute, the panel held a separate meeting with doctoral candidates and undergraduate students associated with the unit. Many of the people involved were, in parallel with their studies, working in funded research projects in the institutes. Others were associated with the institutes by virtue of their status as doctoral candidates.

We gained a general impression that the institutes were serving the needs of young researchers well. At all levels they struck us as knowledgeable and very engaged in their work. Most were active in small, integrated groups, which facilitate transfer of knowledge and create opportunities for individual contributions.

We were able to discuss the work in some specific funded projects with the junior researchers involved. It was clear that participation in research projects was playing a very positive role in the education of junior researchers in linguistics and computational linguistics in Portugal.

Because of a two or three year funding cycle, there is considerable mobility of participants among projects, and among the three institutes in Lisbon. This appears to be contributing to a general build-up of competence, especially in the computational area.

The time available to doctoral students for their own research varied radically among universities. In some cases conditions appeared to be very good, while in one case doctoral candidates have extremely heavy teaching duties. While we are not able to recommend remedies, where such conditions prevail it would be very desirable to increase the amount of time available to doctoral candidates for their own work.

Computational and resource research

Creation of language resources, computational linguistic applications, and linguistic research using computational methodology figures in the work of three of the institutes reviewed (CLUNL, ILTEC, and CLUL).

Examination of written material in numerous cases raised doubts about the results of computational and resource projects, because of an absence of reference journal publications, papers in competitive conferences, published linguistic resources, or available computational prototypes. Some these doubts were alleviated during site visits, when we were shown materials, which had recently been published, or were in the process of completion. However, we call attention to the need for publication of the results of computational and resource- motivated work. The present state of affairs is a barrier to scientific progress. Discussions during site visits revealed that turnaround times of several weeks for concordance queries in reference corpora are typical, as a result of corpora not having been published (for instance on CDROM In some cases (for instance terminology, lexical resources speech, and historical manuscripts) involvement in international research consortia and exploitation of internationally prominent methodologies is contributing to rapid increase in computational mastery of the Portuguese language, and competence in computational methods. In others cases, it is unclear whether successions of short and rigidly structured projects are resulting in long-term progress. Research groups need to establish basic technologies, data bases, methodologies, and linguistic knowledge which can be exploited in small projects with varying funding sources over several funding cycles, and in both applications projects and projects with scientific goals. Researchers at CLUNL and CLUL have initiated linguistic research in historical and dialectical linguistics using a data-oriented research methodology. The work has the potential of answering linguistic questions which could not be addressed in others ways. If successful, it could be extended in several directions (for instance syntactic and phonetic research on contemporary language). The availability of extensive text and speech corpora suggests powerful synergies.

As already mentioned, there is evidence of insufficient computational expertise in research projects using computational and data-oriented methodology or concerned with corpora. Here ILTEC is an exception, where extensive computational expertise and experience are

available. However, at ILTEC, lack of involvement of PhD researchers with computational research programs and stable university faculty positions is a serious problem.

Policy recommendations

The triennial funding program provides essential though modest base funding for research in linguistics, and the structure is appropriate.

In the institutes reviewed, there are young PhD researchers with the training, interest, and talent to do innovative research in linguistics employing modern theoretical perspectives and novel methodologies. Appropriate research programs have been initiated. It would be desirable to ensure that funding calls where proposals for innovative scientific research in linguistics can find a place continue to be available.

In order to facilitate work with computational methodologies, laboratory facilities in the linguistics units, including computer hardware and networks must be modernized. Research units should prepare proposals for modernization. The current scope and organization of research in computational linguistics in Portugal may be inappropriate, given the scientific, technological, and economic importance of this field. The FCT should consider a reorganization of efforts in this area.

6. Arts and Humanities / Artes e Humanidades

6.1 LITERATURE / ESTUDOS LITERÁRIOS

Panel Coordinator:

Maria Irene Ramalho
Universidade de Coimbra, P

Evaluation Panel:

Helder Macedo
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Hugh Ridley
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Nancy Armstrong
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Page duBois
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Ziva Ben-Porat
Tel Aviv University, Tel Aviv, ISRAEL

In the Spring of 1999, Professor Luís Magalhães, President of FCT, appointed me chair of the Evaluation Team to assess the FCT-funded research units engaging in Literary Studies in the country. This was to be the second triennial evaluation of the research centers in question.

My first job was to put together an international committee of highly respected and competent scholars in a variety of fields, to account for the many subjects and specialties dealt with in the eleven research centers to be reviewed. Given the way the centers named and described themselves, and the kind of work they produced, in choosing my reviewing committee I had to keep in mind such a wide range of subject areas as Classics, Romance and Portuguese Studies, English and American Studies, German Studies, as well as Comparative Literature, Literary Theory, Cultural Studies, and Womens's Studies. I am satisfied that my Evaluation Team adequately covered the research fields of the various research units. Members of the team were Professors Page duBois, Classics (University of California, San Diego, USA), Helder Macedo, Portuguese and Renaissance Studies (King's College London, UK), Nancy Armstrong, English and American Studies, Women's Studies, and Cultural Studies (Brown University, USA), Hugh Ridley, German Studies (University College Dublin, Ireland), and Ziva Ben-Porat, Comparative Literature and Literary Theory (Tel Aviv University, Israel).

My experience was a very exhausting but also a very rewarding one. When my international colleagues joined me in Lisbon in late June for our first meeting, they had prepared well by reading the various units' reports. All of them had had previous experience evaluating research and teaching units and were able to contribute to the

reviewing tasks very productively. Professor Ridley, who could only join us a couple of days later because of previous commitments, had been conscientious enough to send me substantial faxes concerning the centers in Lisbon which he would be unable to visit, but whose previously submitted reports he had read carefully. As an Irish professor of German in Ireland, he also had some very useful general remarks to make on options for valid research on foreign languages, literatures, and cultures in a semiperipheral country like Portugal.

For a week, my team of evaluators and I visited the various centers to be reviewed in different parts of Portugal, and met for discussion and to compare notes and criteria every evening. Since all members of the group were learned, well-informed, and competent professionals in the field broadly considered, and were all intent on performing their job with scientific rigor and intellectual honesty, a good general rapport was created from the very beginning, and so my chores as chair were made much easier, and indeed very pleasant. Professor Macedo, who had already been on the first reviewing committee three years before, was particularly helpful in establishing a good relationship between the committee and the research units. His inside knowledge was welcomed as well in that it helped the evaluation team to focus on the relevant issues and have a better understanding of some of the problems affecting the different research units. I am most indebted to all of my collaborators for my general remarks here, though I would be reluctant to hold them responsible for my views on the state of literary studies in Portugal.

As a whole, the field of literary studies in Portugal is either doing well or full of promise. Of the eleven centers under evaluation, one was rated Excellent (Centro de Estudos Clássicos, Universidade de Lisboa) and four Very Good (Centro de Estudos Anglisticos, Universidade de Lisboa; Centro de Estudos Clássicos e Humanísticos and Centro Interuniversitário de Estudos Germanísticos, Universidade de Coimbra; and Centro de Estudos Humanísticos, Universidade do Minho-Braga). Excellence is, however, well within reach of all these Very Good four centers, as the individual reports clearly indicate. Of the other six, only two were weak enough to be rated Fair (Centro de Estudos de Culturas Lusófonas, Universidade Nova de Lisboa; Centro de Línguas e Culturas, Universidade de Aveiro). Both units include some highly accomplished scholars amongst their researchers, and the reasons for the team to rate them Fair were different, as the individual reports explain as well. The remaining four research units were assessed Good (Centro de Literaturas de Expressão Portuguesa, Universidade de Lisboa; Centro de Estudos Anglo-Portugueses, Universidade Nova de Lisboa; Centro de Literatura e Cultura Portuguesa e Brasileira, Universidade Católica Portuguesa; Centro Interuniversitário de Estudos Camonianos, Universidade de Coimbra).

If one adds to this general assessment the fact that some of the best professionals in the field in Portugal are not affiliated with any of the centers under this team's evaluation, the conclusion must be drawn that literary studies are not faring too badly in this country. The encouragement given by FCT to the creation of research units for literary studies, to be periodically evaluated by an international team of specialists, has clearly boosted the field, not only by giving visibility to the production of results as a far more collective enterprise than previously thought (even in the case of individual projects) but also by highlighting the need for exchange, debate, cross-reference, and accountability. Some more exchange amongst the different centers themselves, often with unacknowledged similar interests and

objectives, would certainly be advantageous to all concerned. One of the centers in particular, Centro Interuniversitário de Estudos Camonianos (Universidade de Coimbra), given its special national interest, has great responsibility in promoting the networking of scholars in the field, both in Portugal and abroad. Hence the team's recommendation for programming funding.

Other ways of improvement come to mind as well. Research units should be encouraged to work more consistently on their own internal scientific coherence. Some of the centers seem to coincide roughly with university departments, in which case research priorities and the relationship between research and teaching are not always easy to understand (also hard to understand in such cases is why not every member of the department is involved); others, on the contrary, give the impression of a maverick group of academics engaged in disparate kinds of research and hastily put together in order to be evaluated as an FCT research unit. Nothing wrong with either instance at the start of a center (for the financial and other benefits it brings), but one would hope that after a few years theoretical guidelines, research priorities, and scientific articulation of fields and topics would have been thought through and established.

As a rule, and not surprisingly, even the most accomplished centers feel more comfortable and do best with subject matters with a longer tradition in Portugal, such as literary history and philology, translation/reception, source and influence studies, period and genre comparativism, and, last but not least, editions, especially annotated editions for secondary school students. Some very fine results in these areas can be observed in several of the centers, though one would hope to see the more exciting challenges brought about by the most recent theoretical developments in the study of literature and culture, as well as by developments in historically situated comparative, gender, and cultural studies, to have more impact on research emphases and priorities. Literary research that asks questions about itself as it goes along, beyond the narrow conventional borders of national academia and traditional scholarship, and ends up achieving pathbreaking results, should be encouraged. In this regard, the efforts of younger scholars, often trained or having had some experience abroad, to engage in scholarly exchange and make the discipline problematic by putting it in international perspective, are particularly to be praised. In some cases, what seems to be missing is more willingness on the part of unit leaders to delegate power and encourage innovation. Sometimes, the problem lies in the wide gap between the very high achievement of a leader, both at the national and international level, and the lesser accomplishments of that particular leader's younger colleagues. But this is something that time will eventually take care of.

Publication is sometimes a problem. More funding should be allocated for the publication of academic work in the field of literary studies. Things may be changing but, to the best of my knowledge, though some of them are sometimes commercially brought out, most doctoral dissertations in literary studies are still not usually published in Portugal with FCT or Gulbenkian funding, unless they fall into the priorities of "national interest," at least until recently primarily defined as "Portuguese" ("Literature," "Linguistics," "History"). Theoretically, it may well have happened (I am not saying it has) that mediocre thesis with "national interest" thus defined have ended up being selected for publication funding to the detriment of excellent thesis in English, American, German, French, or Comparative Literature. What I am saying is that "national interest" should give way to "excellence" in

any field, and that the very concept of “excellence” should be periodically revised by panels of national and international scholars.

When centers have their own journals and presses, or have their own funding for publication, which is increasingly the case, the risk is that the essays are not properly read and discussed by referees from a broad scientific community. Even when the competence and quality of scholars are not in question (and often they are not), one would wish scientific production in literary studies in Portugal to be more widely refereed and less home-based. I and my team of evaluators faced in some cases the initial distrust of unit researchers vis-à-vis scholars who “know too little of the subject matter” (e.g., “Portuguese Literature” or “Portugal-X cultural relations”) and who presumably “have no way of appreciating the work being done.” Although this kind of stubborn resistance to outside referees and evaluators with a truly international perspective is usually very strong among Portuguese scholars, and must be firmly fought against, in our case the impression seemed to be completely dispelled by the end of the team’s visit to the unit, no doubt because, in the course of the visits, the evaluators showed considerable inside knowledge of higher education and scholarship in Portugal as well. Professor Helder Macedo’s privileged position as outsider and insider at one and the same time is, of course, highly respected by Portuguese scholars. But all the other evaluators have had contact with Portuguese scholarship in their respective fields. Prof. Nancy Armstrong’s collaboration with Portuguese higher education and research has actually been quite intensive for several years, and dates back from the late seventies, when she held a Fulbright position at the University of Coimbra.

On the other hand, it is fair to observe that, by and large, Portuguese scholarship in literary studies deserves to be better known abroad. The language in which most of it is mainly written is of course a problem, but not the only one. The solution is not to stop writing in Portuguese and write everything in English (following the example of the so-called “hard” sciences). Such a strategy would, in the long run, have dire results for the Portuguese language and culture. But summaries in other languages should always be included in journals, collections of essays or volumes of proceedings. More important still is the national and international indexing of Portuguese journals so that scholars elsewhere have a chance to know at least what has appeared in them. A good program of funded translations is also something to think about.

Internationalization is a related problem. FCT puts a great emphasis on internationalization, and rightly so. There seems to be little problem with funding earmarked for independent research abroad. Researchers also have ample opportunity to participate in and present papers at conferences abroad, or to organize conferences at home with the participation of leading foreign scholars in the field. But worthwhile, well-balanced internationalization, involving effective two-way collaboration with scholars in accredited institutions abroad, is hard to achieve. For reasons that have also to do with the financing traditions of higher learning in Portugal, it seems to be harder in the Humanities than in Science and Technology, or even in the Social Sciences. Research units must be encouraged and get adequate support to double their efforts in that direction.

The same goes for publishing in foreign mainstream journals or major presses. Since some of the most original types of research at most research units are often related to M. A. or

Ph. D. dissertations, and since dissertations are written in Portuguese (as they should be), the strategies to make the results internationally known often stumble on the question of language as well. Again, once funding for publication in Portuguese is not solely dependent on national referees, a recommendation for publication in Portugal might also imply a recommendation for translation into a foreign language (if only of a portion of the work in question) with suggestions about publishers or periodicals for submission. A translation policy in literary studies, which I am not even sure exists in Portugal, should concern not only the translation into Portuguese of key texts in the field originally written in a foreign language, but also the translation into a foreign language of outstanding work originally written in Portuguese by Portuguese scholars.

None of the units evaluated have full-time researchers. Researchers are all part-time and usually teachers at the school that hosts the center, a combination that is good in itself. In the case of two of the centers (Centro Interuniversitário de Estudos Camonianos and Centro Interuniversitário de Estudos Germanísticos), though for slightly different reasons, the evaluation team agreed that a recommendation for programming funding to allow the centers to hire full-time researchers was justified. However, having in mind what has been happening in centers for science and technology for quite some time, a more general plea for full-time researchers in at least the stronger centers for literary studies is highly justified at this stage. For one thing, given the job market in higher education, some of the brightest and intellectually most valid graduates in languages and literatures, those better prepared to engage in research in literary studies, are being left out of academia, even after they have brilliantly completed an M. A. degree. As is often the case in Portugal, the only option left to them then is high-school teaching. Granted that excellent high-school teachers are also needed, and that high-school teachers can also be researchers, experience shows that very few of them will persevere in trying to reconcile demanding teaching with demanding research that has little relevance for their teaching tasks.

Secondly, being a full-time researcher doesn't have to mean doing literally no university teaching at all, only that the contractual affiliation is with the research unit, and not with the school that hosts it. Agreements could in time be made between the center and the school in question to arrange for occasional part-time substitute teaching to allow a particular (part-time) researcher, for example, to complete a given project, prepare a manuscript for publication or accept an invitation to participate in some specific national or international project. Full-time researchers, who usually have many other time-consuming academic functions besides teaching, could easily increase their and the center's production output without putting the needs and demands of their own teaching at risk. Or be demanding and dedicated teachers and supervisors without neglecting their research. Needless to say, such an arrangement calls for a very clear and unambiguous relationship between the research units and their hosting institutions. In fact, this relationship needs perhaps to be clarified, as shown by the unfortunate incident provoked by the Dean of the Faculty of Letters of the University of Coimbra on the occasion of the evaluation team's visit to the Centro de Estudos Clássicos e Humanísticos, of which he is also a member.

As far as the new research technologies go, the large majority of the units we visited were well-equipped. Whether in most cases the equipment was being efficiently used by well-trained people to the best advantage of the research being conducted at the unit, was not always easy to ascertain. In any case, and though the use of the most recent research

technologies in the study of literary and cultural phenomena is highly commendable, books and journals still constitute the major references in the field, and funding for library building should continue to be generous.

Maria Irene Ramalho de Sousa Santos

6.2 ARTS AND ARCHITECTURE / ESTUDOS ARTÍSTICOS

Panel Coordinator:

Natália Ferreira Alves

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Evaluation Panel:

Dolores Vila Jato

Faculdade de Geografía y Historia, Santiago, SP

José Monléon

Catedrático Sociología do Teatro, Madrid, SP

Pedro Navascues

Escuela Técnica Superior de Arquitectura de Madrid, SP

Em Portugal, na década de 90, assistiu-se a um desenvolvimento crescente da investigação na área dos Estudos Artísticos, se bem que em relação aos outros sectores da Ciência e da Tecnologia (particularmente os vários ramos das Ciências Sociais e Humanas), se deva apontar à partida que o facto de nos encontrarmos perante uma área nova, ainda em formação, dificulta a análise comparativa das diversas unidades que seria imprescindível para se ter uma visão global da investigação científica praticada no país.

Uma primeira reflexão se impõe: a mudança radical observada na sociedade portuguesa nos últimos vinte e cinco anos, com a conseqüente abertura a uma internacionalização (que se deseja cada vez mais assumida de forma criteriosa), possibilitou o aparecimento de um campo propício a manifestações culturais, nacionais e estrangeiras, onde o Teatro, as Artes Plásticas, a Arquitectura, a História da Arte e o novo mundo dos *media* foram ganhando paulatinamente o seu próprio espaço. As transformações operadas no panorama cultural do país irão ser determinantes para um empenho decisivo das entidades oficiais, quer pelo patrocínio de inúmeros eventos artísticos (com particular incidência para as exposições que se têm vindo a realizar a um ritmo intenso), quer pelo apoio dado a investigadores cujas pesquisas são vitais para que muitos desses eventos tenham a necessária credibilidade e reconhecimento no meio científico.

A Universidade surge, assim, na comunidade em que se encontra inserida, como um foco dinamizador e produtor de cultura, com uma vertente ligada à investigação que tem produzido resultados significativos no período em análise. Com efeito, o número de dissertações de mestrado e de doutoramento tem vindo a aumentar, testemunhando o interesse crescente que as duas últimas gerações têm dedicado à pesquisa científica, sendo também relevante o número de publicações nacionais reconhecidas internacionalmente.

Neste contexto, a criação de unidades de investigação no meio universitário, viabilizou a implementação de projectos que, de outra forma, não teriam a sequência desejável. Presentemente, essas unidades no âmbito dos Estudos Artísticos distribuem-se pelas áreas

do **Teatro** (Centro de Estudos de Teatro – Faculdade de Letras da Universidade de Lisboa), da **Arquitectura** (Centro de Estudos de Arquitectura e Urbanismo – Faculdade de Arquitectura da Universidade do Porto; Centro de Estudos de Arquitectura – Faculdade de Ciências e Tecnologia da Universidade de Coimbra), da **Comunicação e Arte** (Unidade de Investigação em Comunicação e Arte – Universidade de Aveiro) e da **História da Arte** (Centro de História da Arte – Universidade de Évora; Instituto de História da Arte - Faculdade de Ciências Sociais e Humanas da Universidade Nova de Lisboa). Há, pois, que referir um dado importante: quer as três unidades, cuja proposta de criação foi analisada pelos Avaliadores e pela Coordenadora do Painel, quer as outras três que se encontravam num plano mais desenvolvido, evidenciaram um perfil diversificado, inerente às respectivas pesquisas programadas.

Nas unidades de candidatura inicial (Comunicação e Arte – Aveiro; Centro de Estudos de Arquitectura – Coimbra; e Instituto de História da Arte – Lisboa), as linhas de investigação revelaram algumas assimetrias relativamente ao equilíbrio desejado para um desenvolvimento equitativo, sendo aconselhável uma reorganização da estratégia programática.

Tal facto foi comprovado na unidade de Aveiro, para a qual se recomendou um acompanhamento especial para as linhas de Comunicação e Arte e Comunicação e Design; e no Instituto de História da Arte (Lisboa), com uma linha de Arte Clássica com uma estrutura débil relativamente às áreas medieval e contemporânea; quanto ao C. E. de Arquitectura, de Coimbra, foi notória a coincidência do Centro de Estudos com o Departamento de Arquitectura, que não pareceu adequada ao fins visados.

Por sua vez, a observação cuidada dos resultados apresentados pelas unidades em actividade, fornece informações preciosas. O Centro de Teatro, já anteriormente classificado de *Excelente*, manteve a sua postura de qualidade, com linhas que investem em temas de ponta; porém, é óbvia a urgência de apoio financeiro não só para o pleno desenvolvimento dos projectos, mas também para a divulgação dos mesmos a nível internacional.

O Centro de História da Arte (Évora) demonstrou uma grande vitalidade em todas as linhas de investigação implementadas, com alguns projectos já concluídos, o que constitui um ponto positivo na sua actuação. Com uma estratégia segura, tem conseguido desenvolver no terreno uma pesquisa sólida que, graças à utilização de parâmetros diversificados, tem gerado uma dinâmica que servirá, por certo, de termo de comparação a outros futuros centros na área da História da Arte. Contudo, devemos apontar a necessidade de financiamento que possibilite a sua evolução, inclusivamente com a inserção de novas linhas.

O Centro de Arquitectura (Porto) cuja classificação anterior de *Excelente*, fazia prever a existência de uma unidade de investigação de alto nível, na linha do prestígio que caracteriza a Escola do Porto, apresentou distorções relativamente aos princípios programáticos, tendo sido recomendada uma reestruturação urgente que lhe devolva a suposta articulação inicial.

Concluindo: Os Estudos Artísticos são ainda uma área em fase de crescimento, com as potencialidades e as fraquezas inerentes a tal facto. Embora os núcleos já constituídos evidenciem uma grande vontade na abertura de novos caminhos para a investigação em Portugal, temos de assumir colectivamente o seu número diminuto, as assimetrias e as distorções verificadas, próprias de quem iniciou um percurso. Para que a Universidade portuguesa consiga, também neste campo, ombrear com as suas congéneres mundiais, ter-se-á que considerar a Arte, globalmente entendida, como parte integrante do nosso quotidiano, e o trabalho desenvolvido pelos investigadores como essencial para a compreensão da criatividade do Homem nas suas múltiplas facetas.

6.3 PHILOSOPHY / FILOSOFIA

Panel Coordinator:

Fernando Gil

École des Hautes Études en Sciences Sociales, Paris, F

Evaluation Panel:

Elhanan Yakira

Hebrew University of Jerusalem Institute of Languages, Literature and Art, Jerusalem, ISRAEL

Frédéric Nef

Université de Rennes 1, Rennes, FR

Pierre Bouretz

École des Hautes Études en Sciences Sociales, Paris, F

Quintín Racionero

Universidad Complutense, Madrid, SP

As observações que se seguem devem ser lidas no contexto da situação da filosofia em Portugal. Se substantivamente ela não se alterou nos últimos anos, continuando assim válidas as análises que constam do *Perfil* da disciplina publicado em 1999 pelo OCT, a presente avaliação permite chamar a atenção mais detidamente para alguns pontos. Alguns deles acham-se em relação directa com o enquadramento actual da investigação portuguesa e parecem por isso particularmente relevantes.

Como se diz no *Perfil*, a pesquisa filosófica atravessa uma fase de autêntica renovação, para o que muito tem contribuído o seu financiamento, decuplicado (ou mais do que isso) nos últimos anos : poucas outras disciplinas terão beneficiado tanto da política científica portuguesa actual. Traduz-se isso em termos quantitativos por um aumento notável do número de projectos e de publicações, e qualitativamente pela considerável diversificação da pesquisa e por um empenhamento muito mais forte do que no passado. Como seria de esperar, este progresso acompanha-se por alguns aspectos menos positivos que são o seu reverso e que a presente avaliação permitiu evidenciar (acham-se apontados nos juízos emitidos pelo painel, com as recomendações correspondentes). Saliento os seguintes, permitindo-me notar que eles são corroborados pelo que se pode observar em outras unidades de investigação, para além das avaliadas:

- A tendência para uma justaposição de projectos dentro das unidades, sem grande (ou nenhuma) articulação interna. Percebe-se que assim seja, na medida em que as próprias facilidades oferecidas fazem que os centros se configurem às vezes como quase reduplicações de departamentos inteiros ou de meios-departamentos. Mas é uma tendência perigosa, pois tende por seu turno a conduzir à

- Insuficiente estruturação de cada pesquisa, perdendo-se a vantagem que representa a associação de diferentes investigadores no quadro de um projecto comum: tal deveria contudo ser a finalidade das unidades enquanto tais.

- Por outro lado, o próprio *take-off* actual traz consigo uma diversificação muito sensível dos temas de pesquisa. Os nossos investigadores estão cada vez mais interessados em questões que são temas de pontas no estrangeiro. Mas a falta de uma tradição que é o *handicap* principal da investigação portuguesa, e não só em Filosofia, faz que a importação dos temas não vá sempre a par de uma maturação conceptual endógena. Julgo que se trata de uma fase inevitável que o próprio progresso da investigação corrigirá: temos boas razões para supor que essa tradição se está pouco a pouco a constituir.

Um outro problema - em que a investigação em Filosofia, salvo felizes excepções, se acha porventura em atraso relativamente às ciências humanas, para não falar nas exactas - reside numa insuficiente internacionalização, entendendo por aí sobretudo a participação em projectos internacionais e outras actividades realizadas de pareceria com centros e colegas estrangeiros. Também em matéria de teses de doutoramento, tenderia a pensar que a proporção das teses realizadas (ou co-realizadas) no estrangeiro é muito menor do que em outras áreas. O mesmo se pode dizer das estadias de investigação no estrangeiro no que toca às teses dirigidas por professores portugueses.

Fernando Gil

6.4 HISTORY / HISTÓRIA

Panel Coordinator:

Luís Adão da Fonseca

Instituto de Documentação Histórica da Faculdade de Letras do Porto, PT

Evaluation Panel:

Adéline Rocquoi

École Pratique des Hautes Études, Paris, F

Franco Angiolini

Universidade de Pisa, IT

Salvador Claramunt

University of Barcelona, SP

Este relatório final diz respeito às visitas realizadas às unidades de História, no âmbito da avaliação, que teve lugar entre os dias 8 e 13 do passado mês de Novembro de 1999.

No total, foram visitadas onze unidades, a saber:

- Centro de Estudos Históricos (Universidade Nova de Lisboa)
- Centro de História da Cultura (Universidade Nova de Lisboa)
- Centro de História (Universidade de Lisboa)
- Instituto de Coordenação da Investigação Científica (Universidade Católica Portuguesa)
- Centro de História Contemporânea (ISCTE. Lisboa)
- Centro de Estudos Arqueológicos das Univ. de Coimbra e Porto (Univ. de Coimbra)
- Centro de História da Sociedade e da Cultura (Universidade de Coimbra)
- Centro de Estudos da População e Família - CEPFAM (Universidade do Porto)
- Centro Interuniversitário de História da Espiritualidade (Universidade do Porto)
- Centro de Estudos de História da Viticultura Duriense (Universidade do Porto)
- Centro de Ciências Históricas e Sociais (Universidade do Minho)

Todas as reuniões realizaram-se em clima de franca abertura por parte dos responsáveis de cada unidade, e, em todas elas, estiveram presentes - participando activamente na troca de impressões - uma parte maioritária dos seus membros.

Assim - no que ao universo de investigadores envolvido diz respeito -, como observação geral de carácter muito positivo, deve ser ressaltada, para começar, a grande **disponibilidade de trabalho** manifestada por todos os investigadores, quase todos simultaneamente docentes universitários, sendo visível, na esmagadora maioria das situações, a quantidade e qualidade de trabalho individual realizado. Para citar um exemplo, refira-se o número médio de títulos publicado - excepto numa unidade, sempre superior a 1 trabalho/ano -.

Por isto, a Comissão Avaliadora, desde o princípio entendeu que devia **sublinhar positivamente a circunstância dos docentes universitários em causa participarem nestas actividades**, porque entendeu constituir esta participação um ponto de partida importante, merecedor de valorização adequada.

Se se comparar o resultado global desta avaliação com as classificações obtidas pelas mesmas unidades na avaliação anterior, nota-se ainda que **as unidades realizaram um esforço real - em alguns casos, muito significativo - no sentido de corresponderam às recomendações formuladas então pela Comissão de Avaliação.**

Há, com efeito, uma melhoria global das classificações agora dadas: das 11 unidades visitadas, sobem 5, recebem uma apreciação igual 3, desce 1 (a respeito de 2, porque a classificação anterior se reporta também a outras áreas temáticas, não é possível fazer comparações). É, assim, de admitir que esta melhoria resulte da referida preocupação de correspondência.

Se esta possibilidade corresponde à verdade, constitui um factor importante a favor do interesse deste tipo de avaliação.

Seja, aliás, acrescentado, como complemento de informação, que - em todos os casos - a classificação foi dada sem que a comissão tivesse conhecimento da valorização final da anterior, e, uma vez que essa valorização foi publicitada pelo coordenador, em nenhum caso entendeu que devia alterar a classificação dada.

Por estas razões, considera-se que o presente relatório deve sobretudo incidir naqueles aspectos que possam vir a representar pontos de partida em ordem a uma futura valorização do trabalho de investigação e correspondente melhoria da produtividade das unidades.

Neste sentido, salvo melhor opinião, entende-se que haveria toda a vantagem **numa melhor clarificação, por parte dos responsáveis das unidades, de todos os aspectos que dizem respeito à programação, definição e respectiva calendarização de objectivos**, incluindo a enunciação clara dos meios que se pretendem utilizar e potenciar, grau e incidência da participação de cada um dos membros da unidade, e, finalmente, a tradução financeira de todas as iniciativas.

Com efeito, uma das maiores limitações que a Comissão encontrou no seu trabalho diz respeito à **deficiente apresentação da maioria dos relatórios**. Estes, muitas vezes, aproximam-se mais de um somatório dos usuais relatórios individuais que é costume apresentar nos meios académicos do que de um balanço global de uma equipa de investigação.

É opinião da Comissão que a *Fundação para a Ciência e Tecnologia* pode exercer um papel importante neste domínio, sobretudo se conseguir que as unidades apresentem um programa trienal mais concreto, em função do qual deveria ser posteriormente elaborado o relatório anual ou trienal.

Na verdade, tornou-se evidente, tanto nos relatórios apresentados quanto nas reuniões de trabalho realizadas, uma **insuficiente organização das unidades**, sobretudo nos seguintes domínios: definição de objectivos, atribuição de responsabilidades, e quantificação de custos

Assim, esse desejável plano de trabalho teria benefícios evidentes, em vários aspectos. Com efeito, permitiria:

- a) definir objectivos, a curto e médio prazo;
- b) determinar o grau de responsabilização do grupo, no seu conjunto, e de cada elemento, em particular;
- c) quantificar os custos financeiros de cada projecto;
- d) elaborar relatórios de actividades mais concretos.

Por outro lado, salvo algumas excepções, nota-se que **as unidades não conseguiram ainda ultrapassar uma primeira etapa agregadora dos esforços individuais** (de inegável mérito, na esmagadora maioria das situações), transformando em património colectivo a investigação realizada, e logrando, desta forma, uma *imagem de marca* para cada grupo, com benefícios vários em diferentes níveis.

Como é óbvio, não se trata de desvalorizar o trabalho individual (que, pelo menos, na investigação em ciências humanas é sempre imprescindível), mas sim de reforçar a importância de uma ligação entre os esforços dos diferentes investigadores na persecução de horizontes e metas comuns.

A este propósito, esclareça-se que a Comissão entendeu não se justificar a atribuição da classificação de *Excelente* a nenhum caso, porque, nas unidades visitadas, a afirmação institucional é ainda insuficiente, tanto a a nível de organização e planificação, como a nível de projecção externa.

Num país como Portugal, com a limitada dimensão do seu universo humano, parece desejável que se procure lograr a máxima rendabilização dos meios disponíveis. Esse objectivo exige que se persigam, entre outros, os seguintes objectivos:

- a) obtenção de uma dimensão humana mínima;
- b) maior articulação com as entidades acolhedoras, nomeadamente as universitárias, que permitam maximizar os recursos;
- c) internacionalização das unidades.

O objectivo indicado em primeiro lugar - a **obtenção de uma dimensão humana mínima** - justifica-se pelas circunstâncias de que alguns grupos, com o propósito louvável de agregarem a maioria, se não a totalidade, dos docentes vinculados à respectiva escola na área temática em causa, na realidade, se apresentam como *macro* em termos administrativos, mas, na realidade, são apenas conjuntos de *micro* unidades em termos científicos. Daí que, em algumas unidades, exista uma multiplicação de projectos (o que não é benéfico), em cada um dos quais participa um escasso número de investigadores. Os efeitos perversos a múltiplos níveis são evidentes:

- dificuldade em privilegiar os investimentos, dada a necessidade de distribuição tendencialmente equitativa;
- deficiente *imagem de marca*, uma vez que nem sempre transparece a área científica em que se move;
- dificuldade em calendarizar e apresentar resultados;
- dificuldades na internacionalização.

Aliás, o problema não é tanto o da dimensão *administrativa* da unidade (quantificada em função do número de elementos que, dispersos por várias áreas, dela fazem parte) quanto o da dimensão das *equipas de projecto* (quantificada em função do número de elementos que investigam, em conjunto e articulados, numa determinada linha). É nesta segunda linha que se deverá orientar a investigação futura.

Neste sentido, considera-se que este objectivo seria mais facilmente perseguido se a *Fundação para a Ciência e Tecnologia* criasse condições favorecedoras da formação de unidades mais homogéneas, dedicadas a áreas temáticas menos amplas, definindo um número mínimo de investigadores por cada projecto, e conseguindo, desta forma, aumentar a dimensão humana de cada um.

b) É óbvio que este objectivo só se poderá lograr através de uma participação activa das entidades acolhedoras, que, na totalidade das unidades de História visitadas, são universidades. Por isso, o objectivo indicado em segundo lugar, propugnava por **uma maior e melhor articulação com as referidas entidades acolhedoras**.

Em alguns casos, esta articulação parece funcionar, mas em muitos outros não parece existir. Nas reuniões realizadas, foram mesmo dados sinais de que, em algumas situações, a Universidade/Faculdade não se sente responsabilizada pelo labor de investigação realizado com o apoio da *Fundação para a Ciência e Tecnologia*. Será necessária uma análise cuidadosa das situações concretas, caso a caso, para se determinar onde residem os nós bloqueadores, uma vez que esta Comissão não tem dados suficientes para atribuir responsabilidades. Mas, foram detectadas algumas situações reveladoras, que permitem considerar este objectivo como importante. Por exemplo, chama-se a atenção para as seguintes:

- Investigadores integrados em unidades sem que exista no seio destas um número mínimo de membros dedicados a temas próximos. Nestes casos, deve-se sensibilizar as entidades universitárias acolhedoras no sentido de considerarem como altamente benéfica a participação de investigadores seus em unidades de investigação sediadas em outras universidades.
- Unidades que têm dificuldades, por falta de espaço e/ou de verba, em catalogarem e/ou organizarem a respectiva biblioteca. Nestes casos, não se entende porque razão as respectivas bibliotecas universitárias não acolhem os livros adquiridos, em condições especiais que contemplem as necessidades dos grupos de investigação.
- Unidades com manifesta falta de espaço. Embora, nestes casos, se compreendam as razões desta insuficiência, parece ser imperiosa a necessidade de se encontrar uma solução.

c) **A internacionalização das unidades** é o objectivo indicado em terceiro lugar. Pelos relatórios apresentados e pelas visitas realizadas, tornou-se notória, na maioria das unidades, o desequilíbrio existente entre o alto grau de internacionalização *pessoal* dos seus membros mais qualificados, por um lado, e, por outro lado, o baixo grau de internacionalização *institucional* da unidade. É óbvio que todos estes aspectos têm sempre uma base pessoal, mas também é pacífico que não se podem limitar a ter esta expressão individual.

É certo que a internacionalização não pode ser um objectivo a ser perseguido isoladamente, uma vez que está intimamente ligado a todas as outras dimensões da unidade (*personalidade e imagem de marca* científica, dimensão mínima do número de investigadores envolvidos, etc.), mas não pode de modo algum constituir objectivo secundarizado.

Neste sentido, considera-se que a *Fundação para a Ciência e Tecnologia* poderá ter um papel muito importante na sensibilização (através de diferentes meios, a estudar) das unidades para os seguintes aspectos:

- necessidade de existência de protocolos e acordos de investigação científica com outras universidades estrangeiras, que se traduzam em actividade de investigação regular, com deslocação periódica de pessoal, realização de projectos comuns, etc.;
- presença regular em congressos e reuniões científicas internacionais;

- mobilidade nas deslocações *de e para* unidades de investigação similares de outros países;
- publicações conjuntas.

Todos estes aspectos, para serem postos em prática, exigem medidas complementares, nomeadamente no que diz respeito a uma **maior articulação entre a investigação e a docência**.

Dadas as características das unidades que se dedicam à investigação em História, trata-se de um aspecto sumamente importante.

Se é verdade que, em muitas das unidades visitadas, os respectivos membros mais qualificados participam activamente em diversos cursos de mestrado e dirigem não poucas dissertações de doutoramento, é um facto que poucas vezes existe uma ligação directa entre as investigações realizadas com o apoio da *Fundação para a Ciência e Tecnologia* e a referida docência pós-graduada. Com independência da determinação das responsabilidades de tal facto, é inegável que, em si, esta situação não pode ser admitida e que, portanto, deverá ser alterada.

Tal discrepância, não só prejudica a própria essência do papel que a investigação tem na vida universitária, como limita a capacidade de formação de novos investigadores que se espera de uma unidade de investigação. Por isso, sugere-se que as unidades sejam sensibilizadas no sentido de considerarem indispensável a sua organização e/ou participação em cursos de mestrado e de formação pós-graduada, onde os temas ensinados tenham uma relação directa com as matérias objecto de investigação.

Mas, este objectivo exige, por sua vez, uma paralela **maior articulação entre as unidades de investigação e as universidades**. No âmbito das unidades visitadas, trata-se de um aspecto especialmente importante, uma vez que todas, como já foi dito, estão sediadas em instituições deste cariz.

Aliás, durante as reuniões realizadas por ocasião das visitas, alguns investigadores chamaram a atenção da Comissão para esta circunstância. Com efeito, a ausência de um mecanismo legal que contemple a dimensão da investigação tem, em termos institucionais, sérios inconvenientes.

Na sequência do que se afirmou, seja finalmente referido que a Comissão encontrou alguma dificuldade em avaliar alguns aspectos de pormenor (mas, nem por isso, menos importantes), uma vez que:

- não teve conhecimento da existência de um anterior plano trienal de actividades em função do qual pudesse apreciar as realmente realizadas no triénio em causa (e, a partir daí, avaliar o seu grau de cumprimento);
- os relatórios de actividades recebidos não fornecem informação nem suficientemente organizada nem minimamente quantificada.

Assim, propõe-se que as unidades sejam sensibilizadas no sentido de **melhorarem a qualidade dos respectivos relatórios**, introduzindo um conjunto de informações que permitam uma melhor aferição da sua actividade.

É difícil, em suma, formular juízos gerais sobre a investigação levada a cabo pelas unidades de investigação em Portugal dedicadas à História. Entre outras razões, não foram visitados todos os centros, pelo que as observações que se apresentam a seguir são necessariamente parciais. E, sobretudo, necessitam de uma ponderação global, que não pode ser feita adequadamente neste lugar. Assim:

A. *Qualidade da investigação* - As situações encontradas são bastante díspares. Como se observou anteriormente, o nível médio, no que à produção individual diz respeito, é razoavelmente alto. No entanto, esta constatação:

- não se pode generalizar, porque há docentes universitários (a comissão desconhece qual é a respectiva percentagem, no conjunto nacional) que não estão integrados em unidades de investigação;
- baixa consideravelmente se se olhar pelo prisma institucional, uma vez que, num número bastante alto de situações, as investigações realizadas e os trabalhos publicados obedecem ao ritmo pessoal de cada investigador, sem plano de conjunto, sem estratégia de grupo claramente definida.

Como consequência, o impacto da investigação científica realizada no âmbito da história é inferior ao que seria de esperar pela qualidade de muitas das investigações individuais realizadas. Este aspecto é tanto mais significativo quanto, no que à afirmação internacional diz respeito, são ainda escassos os canais de colaboração regularmente organizados, não se detectaram mecanismos de divulgação externa das investigações realizadas, e é bastante baixa a percentagem de publicações realizadas em línguas estrangeiras comparadas com as publicadas em português.

Neste sentido, entende-se que a *Fundação para a Ciência e Tecnologia* pode ter um papel muito significativo na sensibilização das unidades em ordem à necessidade de:

- definição de áreas estratégicas prioritárias de afirmação internacional (v.g.: Brasil? PALOPs? Península Ibérica e América do Sul? Países latinos? etc.)
- determinação de mecanismos de divulgação externa da investigação realizada (v.g.: recurso a novas tecnologias? repensar a *política* de publicações e sistemas de respectiva distribuição? prioridades na escolha de congressos internacionais?)
- recurso sistemático e mais extenso às novas tecnologias da informação (INTERNET, etc.).

Entende-se que a introdução destas coordenadas - além de muitas outras que foram apontadas neste relatório - poderão, a médio prazo, contribuir de forma decisiva para um aumento da qualidade e impacto da investigação.

B. *Carácter da investigação* - Em face do exposto, é evidente que a investigação realizada em Portugal, no domínio da história, apresenta ainda grandes potencialidades de desenvolvimento. As formas de apoio até ao momento praticadas pela *Fundação para a Ciência e Tecnologia* constituem, sem dúvida, um importante ponto de partida.

C. *Estrutura da investigação* - A avaliar pela realidade das unidades visitadas, o nível de investigação, já de si significativo a nível nacional, ganhará em muito se lhe for dada maior intencionalidade (no domínio da planificação) e capacidade de organização (no domínio da gestão por objectivos), e se se introduzirem fórmulas mais ágeis de competitividade (que beneficiem as unidades de maior qualidade).

Assim, tendo em vista o universo em que a investigação em História se desenvolve em Portugal, parece fundamental que se definam fórmulas claras de articulação com a universidade, e que a participação em actividades de investigação institucionalizada seja contemplada como elemento fundamental na formação contínua e na progressão profissional em todos os graus de ensino.

D. *Utilização dos recursos* - Em relação a este aspecto, entende a Comissão que o problema não reside tanto na eventual boa ou má utilização, quanto na necessidade de a melhorar, o que se terá de traduzir necessariamente numa melhoria em relação ao que se apontou anteriormente: ou seja, todos os aspectos que dizem respeito à programação, definição e respectiva calendarização de objectivos.