

FOREWORD

Five years ago the Consortium decided to contribute to the changes in the Italian University system with the aim of making it more similar to the research systems of the other European countries. To do this, according to the leading research Agencies in Europe, we carried out an external Assessment.

As Chairman of the International Review Committee was chosen professor Alberto Amaral, Rector of the University of Porto and Vice-Chairman of the steering committee for the quality audit programme of the European Conference of Rectors (CRE). The members of the Committee were: Prof. Binne Zwanenburg University of Nijmegen, Netherlands, Professor L. Luisi (Switzerland), Prof. Harun Parlar, Technical University of Munich, Germany and Prof. Martin R. Preston, University of Liverpool, UK.

The two objectives of the assessment were:

- (a) to assess the added value of INCA as a network to the improvement of university-based research in the field of chemistry for the environment;
- (b) to assess the individual units belonging to INCA with respect to their scientific quality and their contributions to the INCA research programmes.

An additional aim was to verify if and how the Consortium responds to the needs of the Italian scientific organization.

The assessment of the research units involved two phases, the first being an internal self-evaluation, which was followed by all external assessment by the International Review Committee. The Structural Evaluation of the Consortium focuses on its organisation, objectives, strategic plan, international collaborations, etc.

The first goal attained during this first Assessment, presented on 1998, was the self-recognition of the 62 Research Units that to be part of a network implied having a common mission. As a consequence of the extended contacts and relations, the budget of the Consortium increased more than 10 times and its internationalisation was strongly reinforced.

Due to this good result, and according to the recommendations of the first assessment, we asked Prof. Amaral to coordinate a second Assessment for the Consortium, with the aim of following our development, and also taking in consideration the rapid changes in the Italian system of research and education. He accepted together with three of the Members of the initial team. We have to emphasise that Prof. Amaral is the co-editor of "Governing Higher Education: National Perspectives on Institutional Governance" (Kluwer Academic Publishers, 2002) and "The Higher Education Managerial Revolution?" (Kluwer Academic Publishers, 2003).

We are confident that the work done, which engaged 69 Research Units for one year, will be useful for better understanding the situation and the problems of the Italian research system, due to the comparison with other European networks. Together with the Assessment of individual research programs, the comments given by the Committee will assist INCA to tackle future challenges. In fact, this exercise may be crucial for the present university system where the evaluation is established as the most important moment for financing the programmes of the Universities.

I am grateful for the support of CIVR and of its President Prof. Franco Cuccurullo. We will follow the CIVR Guidelines for Research Evaluation, which were recently delivered.

The added values of INCA network will possibly be of great consequence for improving the activities at national and international level. In this regard, I'm proud to underline a visible added value attained by INCA: the network of laboratories set up with the small resources of our Consortium, which represents now a gold standard useful for networking Italy in Europe and worldwide.

Operating in this transparent way, INCA wishes to become a powerful tool for Italian regulatory bodies and environment Agencies, in order to continuously improve research and environmental protection.

I thank both the Committee members for their willingness to participate in the review and all the research units for their co-operation before and during the assessment process.

Venice, October 28th, 2003

Pietro Tundo
President of INCA

PREFACE

In 1998 INCA (Consorzio Interuniversitario Nazionale la Chimica per l'Ambiente, Venezia), an Italian consortium of university research units dedicated to the field of chemistry for the environment had its quality assessed by an international Review Committee. The assessment focused both on the quality of the consortium itself and the quality of the consortium's individual research units. At the time the Review Committee recommended that INCA should consider repeating the assessment exercise at intervals of four or five years.

In 2002 INCA's management contacted me as chairman of the first Review Committee to enquire about the possibility of organising an assessment follow-up of the network. This is the reason behind the present exercise, which was performed by a Review Committee quite similar to the one that conducted the 1998 assessment four of the five initial Committee members have been present and the secretary has been replaced.

For the follow-up we have used the same guidelines of 1998 assessment, the only difference being some simplification of the administrative work for those research units already assessed in the previous exercise. For those units the assessment has concentrated on the analysis of developments taking place since 1998, while for the consortium the Review Committee paid special attention to the degree of implementation of the recommendations made in the 1998 report. Special attention was also given to the new specialist laboratories established by INCA.

The Review Committee wants to express its appreciation for the strategy developed by INCA in order to install a sound quality culture thus standing as an outstanding example of good-practice, which should be followed by other Italian networks. The Review Committee wants to draw the attention of the MIUR and the CIVR to these developments taking place at INCA and considers that they should be taken into account both for funding purposes, as well as in the decisions made for the implementation of the Italian system for evaluation of university research activities.

The Review Committee also wants to draw the attention of the relevant Italian authorities and private industries to the fact that INCA has a large pool of the best specialists in the chemistry for environment and this can be used as an important scientific source of expertise for helping to solve problems of Italian chemical industries. This large pool of expertise could be used to look for solutions of problems resulting from, for example, disused industrial plants, or created by the need to put to a different use large industrial complexes that are no longer economically viable. Expertise is also necessary for dealing with the demand for remediation of situations resulting from the long-term accumulation of industrial waste. Other areas such as environmental risk assessment or remediation technologies applied to very complex and fragile systems as is the case of the Venice lagoon are examples of problems that fall squarely within the pool of expertise of INCA's member units.

The number of units submitting self-evaluation reports was roughly the same as the number in 1998. However, as the Review Committee had now significant previous experience the exercise has proved to be somewhat less difficult, despite the size of the operation. The standard of reporting was in general satisfactory, the only exceptions being two cases that the Review Committee has decided not to assess as the quality of reporting was below acceptable standards. It is also interesting to notice that most of the units still reveal difficulties in dealing with some aspects of the guidelines, one of the obvious ones being the critical self-evaluation of the unit. As in the 1998 exercise the Review Committee decided to interview a limited number of leaders from the units thus allowing the Committee to form a more clear view of the situation by sharing its views with researchers that have a more profound knowledge of the advantages and pitfalls of the network's operation.

The Review Committee also had the opportunity of getting acquainted with some of the more recent developments of the Italian university research system, namely an increasing emphasis on relevance of research for Italian society and on efficiency and quality. One of the more important

developments is undoubtedly the establishment of a National Committee for the Evaluation of Research (CIVR) that will probably play an important role in the Italian research panorama and funding decisions.

The Review Committee is grateful for the hospitality of INCA and all its members. A special mention is made of the work developed by Professor Pietro Tundo and Professor Angelo Albini who were the main people responsible for the success of the follow-up, by steering the self-evaluation activities and providing the Committee with relevant information and by organising the visits and contact with relevant scientists. The Committee also expresses its gratitude to the staff of INCA's Roma office that has contributed to the success of the final review visit.

Finally the Review Committee wants to reemphasise the highly relevant position of INCA within the Italian university research panorama and its pioneering work is setting an example of quality culture in research. INCA deserves the recognition of the Italian research community and of the Italian authorities, namely the MIUR and the CIVR.

Matosinhos, October 28th, 2003.

Professor A. Amaral
Chairman of the Review Committee

INTRODUCTION

Aims and starting points

In 1996 the Board of the Consorzio Interuniversitario Nazionale la Chimica per l'Ambiente (INCA) commissioned a research and management evaluation of the Consortium. The aim of the evaluation was twofold:

1. The assessment of the status of research in the chemistry for the environment, based on the individual assessments of the INCA units.
2. The assessment of the mission, strategies and plans (including the organizational structure) of the INCA consortium.

The main objectives of the assessment exercise were firstly to provide the individual research units with an appropriate tool for the improvement and further development of their research efforts, and secondly to provide the INCA consortium (throughout this report short named INCA) with a set of recommendations that could be used for improving its own organisation and for demonstrating to external stakeholders that the network paid due attention to the quality of its operations.

The methodology used for the Quality Review of INCA relied on traditional open communication among international colleagues ('peers') from foreign academic organisations in order to guarantee both independence and the use of international European standards of quality. Attention was focused both on the research units that make up the INCA Consortium as well as on the Consortium as a whole. It is important to stress that the Quality Review of INCA was *responsive* to INCA's needs, mission, culture(s) and situation, and *future-oriented*, with an emphasis on development of the quality of research. Moreover, it had formative intentions (i.e. intended to help form and improve the Consortium's quality management) rather than summative intentions (i.e. passing judgements for accountability reasons).

The fundamental aim of the Quality Review of INCA was to improve all aspects of the network's operations by assisting the Consortium and its constituent research units to maintain and enhance their quality. The Review Committee acted as a mirror for INCA and its units by making explicit the different qualities they have, and in this way also to assuring society (government, industry, etc.) about these qualities. In particular, regarding quality assurance, the aim was to find out how this Consortium fits the needs of the Italian science system, especially in the light of new policy developments in this area.

Based on this, in 1998 an international Review Committee produced the final report of the INCA quality review: "*Research and Management of the Consorzio Interuniversitario Nazionale La Chimica per l'Ambiente*". In it the committee suggested that INCA should periodically ask for an international follow-up of the initial assessment exercise.

In March 2002, following a request from INCA, a follow-up of the initial assessment exercise was organized, its main focus being an analysis of the changes taking place after the 1998

assessment exercise and of the fulfilment of the recommendations contained in the 1998 evaluation report. The review exercise was organized in a way that allowed avoiding unnecessary wastage of time and effort. In that sense, each one of the INCA units already evaluated in 1998 was asked to produce a short self-evaluation report, reporting on the activities taking place since 1998 until 2002. The new INCA units (that adhere to the consortium after the 1998 assessment exercise) were asked to produce a full report using the guidelines set for the 1998 evaluation. A self-assessment report was also asked of the three INCA laboratories (Marghera, Catania and Cagliari), as well as of the INCA as a network.

The follow-up review was organised to reproduce as far as possible the conditions of the 1998 assessment, all the members of the follow-up Committee (with the exception of the secretary) having participated in the former quality exercise. The guidelines for self-reporting were maintained for the new units while being somewhat simplified for the old units (the structure was kept the same although avoiding the duplication of information given in 1998), the focus and goals of assessment were the same as before and the structure and organization of the visits were similar.

Therefore, as in 1998, the review of quality was focused on the quality of research, and on the value added as consequence of the units' membership of the network. Review of the quality of research took place at the level of research units, the goal of the review at this unit level being *maintenance and improvement of quality* of research, through feedback by external reviewers to the research unit members and the management.

The follow-up was structured, as in 1998, in the two traditional main stages common to most quality assessment activities. The follow-up was initiated by internal evaluations or *self-evaluations*, which were made available to an international Review Committee that was responsible for the *external evaluation*.

For the sake of better understanding by people not familiar with quality assessment procedures we repeat the definitions of *self-evaluation* and *external evaluation* as used in the 1998 quality assessment exercise.

A *self-evaluation* has an internal and an external goal. Internally a self-evaluation is the result of collective institutional reflection and an opportunity for quality enhancement of any aspect that is part of the self-evaluation. Externally it provides information to the review committee. The external function should be seen as an incentive to achieve the more important internal function. Confirmation and enhancement of quality is what is aimed at. The Quality Review of INCA wanted to help the Consortium and the research units to achieve that.

The *external evaluations* are meant to delve deeper into the Consortium's quality management and into the quality of research of the constituent research units. The purpose of the external review was to identify strengths and weaknesses in the organization structure of INCA, and to identify strengths and weaknesses in the quality of research of the associated research units. The external reviewers have probed the veracity of the self-evaluation reports. Based on their findings and on their knowledge of the relevant specialisations in chemistry in other countries, the reviewers were able to make some recommendations to the research units and the Consortium.

This follow-up review report gives an assessment of the quality of the research programmes of INCA from an international perspective, based on international scientific quality standards, taking into account the evolution that took place after the first assessment exercise (for the units already assessed). It also refers to the degree of fulfilment of the recommendations made by the Review Committee after the 1998 exercise and to the quality of operation of INCA's laboratories.

As in 1998 this follow-up assessment aims at the improvement of research programmes of the individual units as well as of the management of INCA and its laboratories. The management of INCA has decided that the report will be made public and forwarded to the relevant Italian public authorities.

Assignments to the Review Committee

The management of INCA asked for a follow-up of the previous 1998 international quality assessment exercise. To answer this demand the Review Committee was asked to assess the evolution of the quality of research of each one of the INCA's units since the 1998 first initial assessment exercise. Furthermore the Review Committee had to comment upon the evolution of the research profile, the structure and the management of the INCA consortium, as well as of its laboratories.

The quality assessment procedure was based on the protocol used for the 1998 quality assessment exercise. The assessments of the Review Committee were based on the self-evaluation reports produced by the individual research units, the INCA laboratories and INCA itself. For units being assessed for the first time the guidelines were the same used in 1998 for INCA research units. Units already assessed in 1998 were asked to follow simplified guidelines based on the 1998 protocol, and to concentrate all information in the period following 1998. New guidelines were prepared both for the self-assessment report of the INCA laboratories and for INCA itself. The findings of the Review Committee were laid down in this report made public by the management of INCA.

The management of INCA submitted a grand total of 69 research units to be assessed, between units already assessed (in 1998) and units to be assessed for the first time. The research units are from 28 universities. These universities are listed below:

1. University of Alessandria (1 research unit)
2. University of L'Aquila (2 research units)
3. University of Bari (2 research unit)
4. University of Bologna (8 research units)
5. University of Cagliari (3 research units)
6. University of Calabria (1 research unit)
7. University of Camerino (1 research unit)

8. University of Caserta (1 research unit)
9. University of Catania (6 research units)
10. University of Ferrara (1 research unit)
11. University of Firenze (1 research unit)
12. University of Genova (2 research units)
13. University of Lecce (1 research unit)
14. University of Messina (2 research units)
15. University of Milano (4 research units)
16. University of Napoli (6 research units)
17. University of Palermo (3 research units)
18. University of Parma (2 research units)
19. University of Pavia (2 research units)
20. University of Perugia (1 research unit)
21. University of Roma (3 research units)
22. University of Sassari (1 research unit)
23. University of Torino (3 research units)
24. University of Trieste (3 research units)
25. University of Urbino (1 research unit)
26. University of Venezia (4 research units)
27. University of Verona (1 research unit)
28. University of Viterbo (1 research unit)

All research units are doing chemistry research on one or more of the following thematic areas:

- A. Enzymatic biological and biomimetic techniques for eco-sustainable synthesis and the decontamination of the environment (BIO)
- B. Heterogeneous catalysis for eco-sustainable synthesis and the decontamination of the environment (HET)
- C. Eco-sustainable synthesis (solvents control, photochemistry, catalysis, recycling, etc.) (SYN)
- D. Decontamination techniques (membranes, sonochemistry, photocatalysis, electrochemistry, etc.) (DEC)
- E. Chemistry of ecosystems (soil, water, and air chemistry; impact of synthetic materials on the environment) (ECO)
- F. New monitoring techniques (MON)

Composition of the Review Committee

The Review Committee was composed by the Chairman, who was involved from the beginning of this review, in consultation with the Director and management of INCA, and three additional experts from different European countries. All members of the Review Committee are familiar with the university system and research structures in Italy. Each member possesses specific knowledge of one or more of the thematic areas that are distinguished by INCA. Moreover, the members cover the disciplinary field of chemistry. Other qualities within the Review Committee were expertise regarding quality assessment and quality audit activities, national research funding systems and expertise in research management. In addition, a secretary who was experienced in evaluation in higher education and research was made available to the Review Committee. The Review Committee was composed as follows:

Alberto Amaral

Professor of Chemistry, Director of the Centre for Research in Higher Education Policies (CIPES), Portugal (Chairman)

Harun Parlar

Professor of Chemistry, Chair for Chemical Technical Analyses, Technical University of Munich, Germany

Martin Preston

Doctor, Senior Lecturer in Marine Chemistry, Department of Earth and Ocean Sciences, University of Liverpool, England.

Binne Zwanenburg

Professor of Chemistry, Department of Organic Chemistry, University of Nijmegen, The Netherlands

Maria Joilo Pires da Rosa

Chemical Engineer, researcher of the Centre for Research in Higher Education Policies (CTPES), Portugal, was appointed Secretary of the Committee.

On behalf of the INCA Consortium, Professor Angelo Albini was appointed to coordinate the self-evaluation activities of the Consortium's members and to act as liaison officer between the Consortium and the Review Committee.

Data provided to the Review Committee

The whole follow-up Quality Review of INCA involved three levels: the research units within the associated universities, the INCA laboratories and the Consortium as a whole. On these different levels, different emphases were relevant and, in fact, three different self-evaluation processes were executed. Therefore the basis for the assessments consisted of the self-evaluation reports compiled and provided by the separate research units, the laboratories (Marghera and Cagliari) and the management of INCA. The self-evaluation reports were intended to be not just descriptive, but also evaluative, establishing a critical analysis of the improvements made since the previous assessment exercise (for the units already assessed and for the Consortium as a whole).

In the research units' self-evaluation reports, the emphasis has to be on their quality of research, and on the relevance of their activities to the INCA Consortium. In the self-evaluation of the Consortium as a whole, the self-evaluation report should be not only analytical, but also synthetic, in the sense of presenting the interconnectedness of the various elements of strategies and quality management. In the laboratories' self-evaluation reports the emphasis has to be on their quality of research, but also on their position regarding INCA network (fully integrated into an university or an independent entity) and the services they are intended to provide both for INCA's units and other interested external organisations.

For the sake of better understanding of the exercise we reproduce here some details of the contents of the self-evaluation reports as described in the 1998 report and which are still valid for the follow-up.

To prepare for the review, the Consortium INCA had to investigate its ways of 'handling' quality in its strategic management processes; it also had to give more insight into the actual quality of the research performed within the research units making up the Consortium.

The self-evaluation of the research unit

The documentation of each research unit consisted of a report in which descriptive information was provided about its research programme, the means they have and how they plan to develop the programme. Because of the self-evaluative nature of the process, information about the actual strengths and weaknesses of the programme was also provided. In a self-evaluation process weaknesses are seen as subjects for improvement more than criticisms of the past.

Each new research unit provided information about:

- The university and the position of the unit within its university;
- The organisational structure of the unit, teaching load, numbers of PhD-students, etc.;
- The composition and size of the scientific research staff;
- The funding (personnel and materials);
- Its mission statement;

- Its research programme (the design of the programme, the most impressive results over the past five years and an overview of the programme development in the future (the coming 5 years) including the means needed for realising the programme's mission);
- Its position in networks (intra-university co-operation, regional co-operation national co-operation (including INCA) and international co-operation);
- Its society relevance and impact;
- The research output (number of dissertations, number of articles in scientific journals, etc.);
- The strengths and weaknesses and of the action taken or to be taken to further improve the quality of the unit and to strengthen its viability.

Old units were not asked to repeat information about the university or the position of the unit within its university unless some relevant changes had occurred, but were asked to comment on measures taken to answer critical remarks made in the previous assessment. The self-evaluation section of their report should contain a critical self-analysis of the progress done after the 1998 review. The units were also asked to report on the weak and strong points detected in 1998 and comment on the way they have changed. In addition to the reports, each research unit had to identify five key-publications (the best publications of the research programme).

For each programme the research units provided an overview of the journal impact factors, according to the Institute of Scientific Information (ISI) journal of 1996, of all journals in which the unit published its results. The Journal Impact Factor of a Journal is defined as the number of citations in year T to documents published in the journal in years T-1 and T-2, divided by the number of citable documents published in that journal in the year in years T-1 and T-2.

A proxy for this method was not to analyse individual publications, but to look at the scientific journals that accepted publications of the unit and to compare the relative positions of Journals in specific fields based on their Journal Impact Factors. Although the use of Journal Impact Factors may be disputed, especially when used in a non-specialised environment, they may offer significant information as long as they are used and interpreted by experts and by a peer review panel.

The self-evaluation report, 10 pages long on average, was submitted to the secretariat of INCA, which collected all self-evaluation reports and sent them to the members of the Review Committee.

The self-evaluation of the laboratories

The guidelines for the laboratories were meant to instruct their leaders to provide detailed information about their research activities (as in the case of research units) and their services to outside contractors (including a list of contracts signed by the laboratory) and to other research units of INCA (to evaluate the extent of the utilisation of specialised equipment by members of the network).

Each laboratory provided information about:

- Its historical background and the relationship it maintains with the local university;
- Its organisational structure and position both regionally and nationally;
- The composition of the INCA research staff and other INCA staff;
- The funding (personnel and materials and equipment);
- Its mission statement (including services to outside constituencies).
- Its research programme;
- Its services activities (services to industry or rental of equipment and space);
- The co-operation with the research units (referring the participation of INCA's research units in the laboratory activities);
- Its societal relevance and impact;
- The key publications (full bibliometric details of the laboratory five best scientific publication over the period 1998-2002);
- The strengths and weaknesses and the actions taken or to be taken to further improve the quality of the laboratory and to strengthen its viability. Information was also to be given on how the specialist laboratories have contributed to the research activities of the associated units.

The self-evaluation of INCA

The guidelines for INCA were meant to provide a detailed list of contents for the INCA Self-evaluation Report on the consortium level. These guidelines were intended to cover all written information needed by the Review Committee in a logical order, with emphasis on changes taking place after the 1998 assessment and its consequences.

Therefore:

- INCA was asked to present a critical report concerning the main changes that have taken place since the presentation of the Research and Management Evaluation report.
- INCA was asked to inform on its capacity to reinforce or to maintain its strong points and how far it has been able to alleviate or eliminate the weak points.
- INCA was asked to indicate how far the development plan presented to the 1998 Review Committee was accomplished.
- INCA was asked to inform how far it has been able to implement each of the recommendations of the 1998 report and if some of those recommendations were partly or completely ignored.
- INCA was asked to provide a list of those centres that have cancelled its membership, as well as a list of new members. INCA was asked to state the reasons for cancellation of membership and to list the criteria for membership of the newcomers.

- INCA was asked to provide a critical analysis of the success of the laboratories, namely regarding customer satisfaction, research activity, contracts with industry and local authorities and the balance between time allocated to researchers and time allocated to services.
- INCA was asked to report on the intensity of the use of those facilities by the members of the consortium.
- INCA was asked to explain the criteria used for defining the location of the new specialist facilities.
- INCA was asked to provide a brief and critical presentation of its development plan for the next three years.

Procedure of the Review Committee

Members of the Review Committee first read the self-evaluation reports from the research units and made their own preliminary assessments of the programmes. For each new programme a first and second reviewer was chosen. For the old units reviewers were whenever possible the same as in the 1998 exercise (the exceptions were those resulting from the absence of Professor L. Luisi). They were asked to read all the information and to provide preliminary assessments.

The Review Committee discussed the preliminary assessments during a four-day meeting in Venice (28th June to 1st July, 2003). During this meeting the initial assessments were approved and the Review Committee made a selection of the research units that were to be interviewed. In these discussions the aspects to be assessed were also clarified (see Chapter 2).

Taking into account the number of research units, the fact that this was a follow-up of the first self-assessment exercise and because of the limited time the Review Committee had for making their assessment, it was both impossible and unnecessary to meet with all research units. So only a small number of units were selected for the interviews (6 out of 66), being this selection mainly based in the concerns the Review Committee had about issues of relevance and viability of some of the INCA units under evaluation. It was also decided to interview the Director of the Catania laboratory.

The interviews took place on the 22nd September in Rome, and were accomplished during the final meeting of the Review Committee (20th to 23rd September 2003). Each interview followed a similar pattern, the representatives of the units being asked to discuss with the Committee the relevance of their unit to INCA and the viability of it in the long run (each interview took about one hour). During the 23rd September the Committee interviewed the management of INCA, in order to get a full and thorough understanding of the INCA Consortium's main concerns and difficulties, special emphasis being given to its evolution since the first assessment exercise. Topics that were discussed were the situation of the Catania laboratory, issues related to relevance of some of the research units to INCA activities and questions about INCA membership and the process of

appointment of people to the governing bodies of the Consortium by the universities involved. During this final meeting a review of the individual evaluation reports was done, the assessments of all the individual units being collectively and unanimously decided by the Review Committee. The discussion and preparation of the final assessment report was initiated.

3. MAIN FINDINGS AND RECOMMENDATIONS

3.1. Conclusions

Background

The consortium INCA was founded in 1993 with the aim of creating a national network in the field of chemistry, and received juridical recognition in 1994. By 1998, four years after its implementation, its membership has increased from the initial five universities to the participation of more than 80 research units belonging to 28 universities.

In 1998 following a request from INCA's governing board, an international Review team produced a "Research and Management Evaluation of the Consorzio Interuniversitario Nazionale La Chimica per l'Ambiente (INCA)". At the time the research activities of INCA's member units were classified in four main scientific areas:

- Chemical procedures and clean technology;
- Transformation mechanisms in the environment;
- Advanced analytical methodologies;
- Decontamination.

Sixty-three research units out of the total membership of 80 participated in the assessment exercise.

One of the recommendations of the Review team following the 1998 evaluation exercise was that "INCA continues to address issues of research quality through external review and participation in international research quality programmes". In 2002 the management of INCA asked Professor Alberto Amaral for a follow-up of the 1998 evaluation exercise. The present report is the result of the second evaluation exercise and will be focused on changes taking place after the 1998 assessment exercise and on the analyses of the fulfilment of the recommendations contained in the 1998 evaluation report.

A total of 69 research units from 28 universities participated in the follow-up assessment. Of those, 42 units were already present in the 1998 assessment exercise and 27 are new units. However, 20 units assessed in 1998 did not participate in the follow-up. In a few cases non-participation by these units is related to the retirement or, unfortunately, the untimely death of the scientific leader. For most of the other cases the research leader does not feel that his/her research fits any more in the fields developed by INCA, or having barely participated in the life of the Consortium in the last years,

considers that it is inappropriate to participate in the present assessment. In other cases the reason advanced by the research leader is the fatigue effect resulting from completing many forms and applications for different purposes. Finally as part of some restructuring, the unit Venezia 3 (Catinella) is now present as INCA's Marguera laboratory in Venice (Leader: Selva).

In addition, the Review team decided not to assess the old unit Firenze 1 (Scozzafava) and the new unit Napoli 9 (Santacesaria) because the self-evaluation reports were incomplete and did not meet minimum standards. The new unit Messina 4 (Micalli) was not assessed because its research area lies out of the field of expertise of the Review team. For the follow-up the units were classified into six different thematic areas as already detailed in § 1.2.

The Review team reiterates its opinion already formulated in the 1998 assessment that INCA's decision to ask for periodic public international quality assessment is a fundamental step in ensuring the viability and international reputation of the consortium, and deserves applause. The Review team is convinced that INCA's decision is a guarantee that its management is determined to take all the necessary measures that will ensure that INCA pursues a culture of excellence and improves the quality of its operations by eliminating its weak points.

INCA's quality policy is very timely as it anticipates the decision of the Italian government to create a national Committee for the evaluation of research (Comitato di Indirizzo per la Valutazione delle Ricerche - CIVR) with the broad objectives of favouring the integration of Italian research networks with the European system, improving opportunities for young researchers and increasing the management efficiency of the Italian research system. The CIVR aims also at enhancing the relevance of research following the government guidelines approved in April 2002 by overcoming inefficiencies resulting from overlapping or duplication of activities that lead to resource dispersion, increasing mobility of researchers, developing the system's capacity for attracting more human and financial resources and strengthening collaboration between the research units and the productive world.

According to Professor Franco Cuccurullo, the President of the CIVR, quality, importance, originality/innovation and internationalisation are the four fundamental objectives of the Italian research evaluation system. These objectives are coincident with those of the Review team, as expressed in the Evaluation guidelines and scorecards: Quality (including originality, significance and scientific impact of the research output), Productivity (including number of PhD thesis, number of scientific publications and impact factor analysis, and patents), Relevance (including contribution to the advancement of knowledge or expertise, potential impact and applications in future technologies and position in relevant scientific and other professional networks), and Long-term viability (referred to both scientific resilience and long term needs of society).

On the occasion of the public presentation of the CIVR guidelines for research evaluation (May 20th, 2003), the Minister of Education, University and Research stated

in her speech that the Italian scientific community needs to face some hard tasks such as creating networks and putting together knowledge and awareness, and identifying research structures, areas and sectors able to face and give adequate answers to the great social themes, including environment. And the Minister added that it is necessary to identify those structures, sectors and disciplines to which should be allocated resources on objective bases and with maximum transparency and which are coherent with the acquired judgement of merit.

The Review team considers that INCA has taken steps that have clearly anticipated the present governmental policy on quality of research. Therefore the government and the CIVR might wish to consider the international periodic review of INCA as meeting the most exacting standards of quality assessment, namely regarding the previous clear definition of criteria and methodologies and the independence of the evaluators. This makes INCA a network with a unique quality culture within the Italian system and it is important that this should be recognised by both the MIUR (Ministero dell'Istruzione, dell'Università e della Ricerca) and the CIVR.

In the first assessment exercise the Review took a cautious approach to some aspects of assessment, such as those derived from the loosely defined motivation for INCA membership and the weakness of certain units which could be explained by a number of factors inherent to the tradition of certain universities, as well as to the shortcomings of the Italian research policy (lack of good funding policy, lack of graduate students, lack of international competition in the 'concorsi', etc.). At the time the Review team considered that the weaker units had been shown a 'yellow card' indicating that a clear improvement of the quality of research would be necessary before the next assessment exercise. The Review team considers that the assessment process is now stable and well understood by all units. Therefore, after the initial experimental period, recommendations in the current report are more explicit and direct.

Now that INCA is entering a phase of consolidation it is the right moment to identify the changes necessary to eliminate some still leftover problems that are connected to INCA's remarkable success in attracting a large number of associated centres. The Review team will present a broad view of its main findings regarding what appear to be the major weaknesses to be addressed during the consolidation phase of the consortium, and will also make some recommendations for further development of the project.

INCA is also entering a new phase of the development of the Italian higher education system where funding mechanisms are likely to be changed to take into account new governmental policies. New policies seem to place increasing emphasis on competition, efficiency, relevance, the results of quality assessment and measures of output factors. The Review team believes that INCA should be fully aware of all these changes in order to take advantage of the new opportunities. INCA's present system of quality assessment can play a positive role in capturing the attention of the Italian authorities for the benefit of the consortium.

General impressions of the Committee

Against the general background outlined above, the Review team formed a broad view of the state of chemistry within INCA, as it appears from the self-assessment reports received.

The Review team reaffirms its previous first general impression that the production of the self-assessment report has been a formidable undertaking unprecedented in Italian chemistry. For the follow-up the guidelines for the self-evaluation reports of units to be evaluated for the second time were somewhat simplified. This objective of making the self-evaluation less arduous was not entirely achieved, as there were some reports of fatigue from a limited number of units. The information made available through these reports allowed the committee to gain good insight of the research activities of the individual research units. The Review team first of all wants to emphasise its appreciation of the remarkable work developed by Professor Piero Tundo, INCA's present Director, which is recognised as having made a major contribution to the success of INCA.

This report mainly deals with the shortcomings and recommendations for improvement. However the Committee emphasises that such comments should not be allowed to detract from the very considerable strengths and achievements of INCA and its component units.

The second general impression is still one of large fragmentation and limited collaboration among the research centres. Following the recommendation of the previous assessment, INCA's management has paid attention to the results of the survey with particular regard to the dimension of the research units in terms of personnel and research funds as well as with regard to the mission. The results of the survey show that the units have in average four participants (considering only full time University personnel) but their involvement in research is partial with an average somewhat over two full time equivalents per year in 2001. The Review team considers that the average size of the units is too small and despite some progress each unit has a tendency to work independently and seems to ignore work of other Italian groups.

The third general impression is related to the quality of INCA's membership. The Review team has taken notice of the changes of INCA's membership. Some 20 units present in the first exercise have left INCA or did not participate in the follow-up being replaced by 24 new research units (see Tables X, Y, Z). The Review team formed the impression that this development has been positive insofar as the overall quality of the network has improved. The average scores of the new units are better than those of the units that have dropped out. On the other hand, there is a well-balanced distribution of research units over INCA's six main thematic areas, both in terms of number (Figure 1) and of quality.

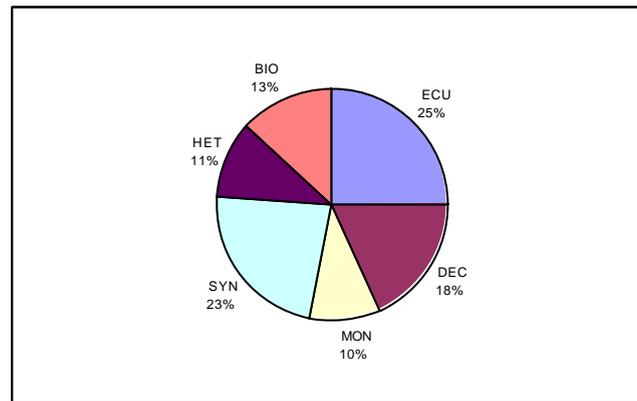


Figure 1: % of research units for each thematic area (first priority).
For a description of the legends see § 1.2

The new division of INCA's activity into the six thematic areas aims at defining a more focused research profile (a recommendation from the previous assessment report). In principle, each unit chooses one area of activity and votes a national representative for that area. The six elected members, together with INCA's president, compose the Scientific Committee of the consortium. The main task of Scientific Committee is to help in the formulation of research programmes that are both better focused and better coordinated. At present five projects with INCA partial funding are already being developed. This activity is reinforced by initiatives from the Management Committee aiming at facilitating the participation of INCA members in national and international research projects, such as those funded by the EU, INTAS, or the COST action.

In response to other recommendation of the 1998 assessment, INCA has extensively changed its management structure. The President is responsible for the overall management of INCA with the collaboration of a five member Steering Committee and presides over the six members Scientific Committee referred above. When necessary temporary ad-hoc committees are appointed for special purposes (e.g., the administration of the 'Law 488' project). INCA has also reinforced its administrative structure, which is now composed of 5 permanent and 3 temporary employees. This allows INCA to help in submission of proposals and in management of projects, while some skilled staff can follow the presentation of proposals both at different ministries and in Brussels. The Review team was however surprised to find out that the staff at the Roma office was not proficient in foreign languages, especially in English. INCA also needs to check that the number of available personnel is not excessive.

Fragmentation and lack of cooperation was one of the main weak points detected by the Review team in the 1998 assessment. Although cooperation among research units

has perhaps not improved as much as desired, there are some visible developments. There are already a number of research projects involving several of INCA's units and financed through plans such as the "Law 488 plan" and the "Sisifo plan". Participation in these plans has only been possible due to the existence and recognition of the consortium. The self-evaluation reports of the individual research units report a considerable number of projects that include the participation of many INCA units from different universities. Examples of this activity are for instance:

- A COFIN/PRIN project coordinated by Professor Giovannozzi (Viterbo 1) with collaboration from Professor Canepa (Genova 1), Professor Beccari (Roma 1), Professor Piccolo (Napoli 2), Professor Previtera (Napoli 4) and Professor Aliotta (Caserta*).
- A SISIFO project with collaboration from Professor Baldi (Venezia 6), Professor Cao (Cagliari 1), Professor Galli (Milano 4), Professor Del Borghi (Genova 2), Professor Piccolo (Napoli 2), Professor Pramauro (Torino*), Professor Zerbinati (Alessandria), Professor Drioli (Calabria), Professor Giovannozzi (Viterbo 1), Professor Mentasti (Torino 2), Professor Beccari (Roma 1) and Professor Canepa (Genova 1).
- A COFIN/PRIN project coordinated by Professor Volpicelli (Napoli*), with collaboration from Professor Beccari (Roma 1), Professor Cecchi (Verona 1), Professor Traversi (Venezia*) and Professor Veglio (Genova*).
- Professor Collucia (Torino 1) reports collaboration with Professor Pelizzetti (Torino 3), Professor Trifiro (Bologna 2), Professor Librando (Catania 5), Professor Crisafulli (Catania 6), Professor Prati (Milano 5), Professor Palmisano (Palermo*), Professor Sartori (Parma 2) and Professor Graziani (Trieste 1).

INCA has also followed the recommendation to develop specialist facilities, which are available to members. Two INCA centres are already in full operation (at Venice – Marghera and Cagliari) while others are starting their activity (Catania, Naples, Lecce, Palermo and Cengio).

The Marghera Centre, the first INCA centre to be implemented, is self-financed and its main activity is the determination of organic micropollutants. The Laboratory is equipped with a range of instrumentation suitable for the determination of ultratrace concentrations of organic micropollutants (High resolution mass spectrometry (HRGC/HRMS Autospec Ultima); Low resolution mass spectrometry (HRGC/LRMS/MS Saturn 2000); Automatic sample purifier (Power-Prep); Apparatus for quick extraction with use of low amount of solvents; INFILTREX for sampling high

* These units are not members of the INCA network.

volumes of water). It operates both as a scientific research unit and as a technical unit generating income through analyses for external organisations.

The Cagliari Centre is equipped with a Philips X-Ray Diffractometer model APD, a Varian ICP-OES model VISTA MPX, and a semi-batch reactor PARR model 4520 at the pilot scale to perform liquid-liquid and gas-liquid reactions. The Laboratory is equipped to perform service as well as research activities. The ICP-OES gives the possibility of performing analytical services for instance in determining trace elements in potable water, in metals of brine, alumina and oils, etc. The XRD instrument available in the Laboratory represents a versatile analytical technique that will be available in research, production and quality control environments to analyse crystalline materials.

The Catania Centre has experienced unexpected difficulties, which were particularly evident to the Review team because the different components of the Centre presented independent reports and there were complaints that it was not working properly. The Catania Centre was established after the acquisition of one Finnigan High-Resolution ICP-MS machine that was installed at the end of 1999 but reported to be fully operative only in March 2001. Apparently other INCA units are not using the equipment and another similar piece of equipment was subsequently acquired by a neighbouring Geology Department. The management of INCA considers that this is one of the weak points of the consortium that needs to be urgently addressed. The Review team will come back to this problem under "Recommendations".

INCA has also devoted efforts to answer the recommendation of the 1998 assessment that it should improve its links with industry. INCA's management report several attempts aiming at establishing stronger links with the organisation of chemical industries (Federchimica) and a major company called ENICHEM. Despite all efforts made by INCA the results are so far quite modest. However INCA has been successful in being given an important role in the management of abandoned industrial facilities and converting industrial sites to new activities (see the SISIFO project).

The evaluation report also contains the assessments of the individual research units. Each unit is individually scored on four different criteria: Scientific Quality, Productivity, Relevance and Viability. The Review team considers that INCA's management should carefully analyse the continuation of the membership of units with overall scores from zero to two (less than satisfactory). If INCA is concerned with scientific efficiency and international relevance, it is difficult to see why such units should be further supported in their present state. At least for those units being assessed for the second time INCA's management might wish to consider replacing the yellow card by a red one. Units with an overall score equal to three are considered satisfactory while those with overall scores of four and five are considered good and excellent, respectively.

The results show that the research units assessed for the first time score better than units being assessed for the second time. Of the new units around 52% are good or excellent, 44% are satisfactory and only 4% have low scores. Of the old units 51% are

good or excellent, around 44% are satisfactory and almost 5% have low scores. This supports the Review team's general impression that the change in membership of INCA over the last five years has improved the quality of the network. It is also interesting to notice that the best research units are not localised in particular regions of Italy, but rather homogeneously spread over the whole country.

A further interesting issue is the overall coherence of the network assessed in terms of the relevance of the research activity of the different units for the main objectives of INCA and in terms of the commitment and loyalty of the units towards the network. The result of INCA's initial fast development, of its loose membership rules, and of the diffuse definition of its mission has been a rather ineffective co-ordination of the network, and a less focused research profile. Over the last five years the number of active units that regularly participate in the Consortium's everyday life has remained rather stable. The fact that there are today other alternative interuniversity consortia has allowed for some adjustment of INCA's membership making the overall situation more coherent. The Review team has concluded that INCA's membership is at present quite homogeneous both in terms of geographic distribution of the better-scored units and in terms of their distribution over the six different thematic areas.

However, it is true that INCA remains a network with a large number of units and that additional measures could improve its coherence while increasing its average quality. The Review team strongly encourages INCA's management to carefully analyse the situation of those units with lower scores.

INCA's management might also wish to consider increasing the coherence of the network by examining the relevance of the research developed by the different units when evaluated against INCA's mission. The chair of the Review team had the opportunity of meeting with the CIVR. The CIVR clearly expressed the view that it would strongly favour a network with a smaller number of members, which would be chosen by their quality and commitment to INCA's mission. The Review team has also verified that some of the units that were recommended to adapt their research profile to converge with INCA's mission failed to do so.

INCA is today in a phase of consolidation and it should carefully take measures to improve its international profile to enhance further its international reputation. This objective is clearly linked to the quality and productivity of its research and to the capacity to develop a coherent profile in terms of research objectives. The Scientific Council has a very important share of responsibility in implementing the appropriate measures to arrive at those objectives.

INCA has increased its external visibility through a diversified set of additional activities, which include education, publishing and international partnerships sponsored by the Italian Ministry of Foreign Affairs and several international organisations. Under the theme of education INCA has established several projects sponsored by the "National Programme for the Professional Training in Environment Chemistry". INCA has also organised several summer schools and international conferences. INCA has also

given several PhD and research grants and awards to Italian companies with significant activity on clean products and processes.

INCA has developed its own publishing policy. In recent years INCA has published several volumes (many of them in the “Green Chemistry” and “Soil Decontamination” series), ranging from conferences and lectures, including reports that highlight innovative and sustainable chemical processes and reviews on the state of the art of green chemistry.

INCA has also developed various international partnerships, for instance those co-financed by the Italian Ministry of Foreign Affairs in the framework of cultural and scientific exchange programmes between Italy and Argentina and Russia, and the representation of Italy in the European Commission’s Cost Action 29 on green and sustainable chemistry and chemical engineering. INCA has established new academic courses and a laboratory in the University of Suez Canal, Egypt.

INCA has managed more than 150 grants for young researchers in the last 3 years, within its research projects showing care in the training and educational activity.

The Review team reiterates its previous opinion that the available data still show a tendency towards the repetition of the same kind of work over the years, without much innovation. Often this work is the heritage of an older Professor who is retiring or has already retired-whereby his field is taken up uncritically by the newer generation. The Review team considers that INCA has a strong responsibility in contributing to the emergence of innovative research projects and practices that will contribute to the development of the Chemistry of the future. It needs to be recognised that industries in general assume a conservative attitude while at the same time they are politically powerful. INCA needs to develop strategic partnerships with some of the more innovative segments of the private sector, and strategic public sectors such as the MIUR, the Ministry for Environment and other relevant public institutions so that the unquestionable competence and knowledge of their researchers can be used as a relevant pool of expertise contributing to the solution of environmental problems, one of the great social themes of today. This will provide INCA with a strong tool to build up its societal relevance and to promote closer partnerships with industry.

The establishment of the INCA consortium has a positive effect in terms of added value to its member units. First of all the network of laboratories allows the research community to use very expensive and specialised equipment that would not be available without a concentration of efforts and contributes to increased efficiency and effectiveness in allocating and using resources. The network also allows INCA’s units to compete for research projects both nationally as well as internationally. INCA’s offices in Roma are very important for promoting the competitiveness of its research units by offering the support of administrative personnel capable of organising the tenders and following INCA’s proposals in the national Ministries and in Brussels. The network has also a policy of internationalisation, education and publication that increases the visibility of INCA relative to that of any individual unit or university. INCA also facilitates the participation of their units in large national and international research

projects as well as in negotiations with industry and the private sector. Finally the network strongly contributes to the increasing collaboration among INCA's units, thus offsetting the traditional isolation of Italian research units and the problems resulting from their normally small dimension.

The Review team wants to conclude these general comments by emphasising that it recognises that Italian universities have to face severe outside constraints in developing their activity, such as an unfavourable legal framework, lack of reliable funds and significant changes in governmental policies. Despite this difficult environment INCA's achievements are remarkable and its unquestionable pledge to develop quality within an international context receives the Committee's wholehearted approval.

3.2. Recommendations

The Review team has formulated a series of recommendations, which are as follows:

That INCA is strongly encouraged to continue its efforts to effectively contribute to the chemistry for the environment as defined in the original objectives.

The Review team wants to express its high regard for the work developed by INCA in the area of chemistry for the environment and to emphasise INCA's relevant progress since the initial 1998 quality assessment. INCA has followed many of the recommendations of the 1998 assessment report and it is today in position to consolidate the network while being seen as a unique example of good practices by other networks and the Italian authorities. The positive results from the operations of INCA deserve additional appreciation insofar as they take place in a difficult context because of deeply rooted public and academic traditions, which include high fragmentation and lack of cooperation of university research units, the long established dominance of a very traditional academic oligarchy, an inadequate legal framework and a weak and volatile financial situation.

Therefore, the critical remarks and the recommendations associated therewith must be seen as a constructive contribution for the appropriate adjustment of INCA when entering the next consolidation phase. These remarks should be seen by Italian public authorities as signs of encouragement to INCA's management in order to facilitate the implementation of changes that will improve the quality of its operations and as such also deserving the support from those same public authorities.

That the mission of INCA is analysed and the criteria for membership are reassessed.

Despite some changes in membership and the competition from a number of other research networks, the number of members of INCA has remained quite stable over the last five years. This means that INCA is a large network that includes around 80 research units from some 28 universities. It also means that INCA's membership is not homogeneous both in terms of quality, or relevance to INCA's objectives or even in loyalty to the network. The Review team has already addressed this problem in the 1998 report. Despite some improvement resulting from changes in membership and from a more clear definition of the areas of research, heterogeneity and fragmentation are still a problem today.

INCA needs to make a decision that will clarify once and for all the rules of membership. Before making the final decision INCA might wish to consider the opinion of the CIVR, which apparently favours smaller networks in terms of membership but also far more homogeneous in terms of research activity and quality.

The Review team considers that the quality component does not raise special difficulty, as the units with lower scores do not represent any significant asset both in terms of geographic distribution and of thematic areas of activity. However, there are cases of units with highly relevant research activity in terms of chemistry but with lower relevance when this is matched against INCA's particular mission and objectives. And there are also cases of units that although having a relevant activity for INCA they do not seem to contribute significantly to the added value of the network, remaining isolated and not contributing to INCA with any additional project or participating in the network's daily activities. INCA needs to address this problem well before another assessment eventually takes place.

The Review team also reinforces its previous recommendation that INCA also has to decide if routine work in the area of environment, such as standard analytical work, which is clearly needed at local and regional level but which is not innovative research, is to be part of its mission.

The Review team recommends that INCA analyses the cases of those units which have never volunteered for the two assessments exercises, and makes an appropriate decision on their membership.

Finally, the Review team has noticed some cases where the titles of the programmes are not entirely appropriate or do not exactly describe the research activity. INCA might consider committing to the Scientific Committee the task of reviewing such programme titles.

That the management structure needs revision to lead into the consolidation stage of INCA's development.

In 1998 the Review team recommended changes to INCA's management structure in order to increase the overall co-ordination of its activities, and to provide effective steering of the network. INCA has followed this recommendation and today Professor Piero Tundo assumes the presidency of the network being responsible for the representation of INCA. Nevertheless INCA should find a capable manager who can relieve him from the heavy burden of routine administrative tasks.

INCA has today a more effective management structure and a Scientific Committee has been set up to ensure better coordination of the research activity. However, INCA needs to further change its statutes to grant that organisational continuity is ensured when the terms of office of the members of the governing bodies come to an end. The amended statutes need to establish a rolling system of representation to guarantee that not more than 1/3 of the total membership of the governing bodies is replaced every year.

That priority is given to improving the degree of co-operation between INCA's units.

Despite some efforts of INCA's management the network still gives an impression of large fragmentation (a large number of rather small and isolated units) and limited collaboration among the research centres. The Review team has taken due notice of the decision of INCA's management to redefine the research thematic areas aiming at a more focused research profile, and to establish a Scientific Committee with strong responsibility in increasing the coherence of research operations and its relevance for the network declared objectives.

However the Review team has formed the opinion that the activity of the Scientific Committee has not yet been very effective, which became evident from the fact that no medium term plan was made available (INCA was supposed to approve and implement a three-year development plan). INCA needs to ensure that the Scientific Committee plays an effective role, namely by helping to define and implement interdisciplinary research projects with participation of several INCA member units. This activity will strongly contribute to the added value of the network by reinforcing its cohesion and helping to solve the problem of fragmentation and lack of cooperation (another component of this policy is the development of the network of specialist laboratories referred to later on).

The Scientific Committee could also examine the possibility of organising specialised discussion groups with eventual participation of representatives of the industry in order to define research profiles common to several units and being of interest to the industry.

That INCA demonstrates that it takes quality seriously and that recommendations from assessment exercises are translated into effective measures.

INCA is well on the way to establish an effective quality culture. It is now in a consolidation phase and should take a more radical attitude on the membership continuation of those research units that had negative assessments. Both internally as well as externally INCA needs to convey the message that quality is a necessary condition for membership.

INCA must give notice of the present follow-up assessment report to its outside stakeholders, and needs to convince the MIUR and the CIVR that the present exercise is a valid alternative to the national quality assessment system. INCA has indeed a unique role in the panorama of Italian university research, as it has been the only network to take the initiative of implementing an assessment system of its research activities using international standards. Therefore the Review team believes that INCA deserves a favourable appreciation from its stakeholders and that it has built a strong case to support its claim to public funding.

The Review team recommends that INCA's Scientific Committee uses the present follow-up report to prepare a development plan with explicit reference to measures addressing its recommendations.

That INCA continues to address issues of research quality through international external review and cooperation with the CIVR quality assessment system.

The Review team recommends that INCA continue to address research quality by periodic external international reviews to develop its credibility. The fact that the Italian government has established the CIVR with the objective of assessing the quality of university research needs to be taken into consideration in order to avoid duplication of activities that might lead to evaluation fatigue. An international review clearly guarantees the independence of the assessment exercise and the present assessment guidelines do not substantially differ from those approved by the CIVR. Therefore the Review team recommends that INCA take steps to have the present international assessment recognised by the CIVR. A similar situation can be observed in Finland where the national evaluation committee has validated international evaluation exercises.

That INCA develops effective links with industry, and relevant Ministries.

The Review team has recognised the efforts of INCA to establish effective alliances with industry. However so far the results obtained have fallen rather short of expectations. One possible explanation of this apparent failure may be the traditional conservative attitudes of large sectors of the chemical industry and their mistrust towards environment protection activities, especially when they are supported by a more radical “green” philosophy. Drastic measures of environment protection may represent large increases in industrial operational costs and as such it is no wonder that creating trust between INCA and industry is not an easy task. It is suggested that a strategy based on the economic benefits of green chemistry rather than the detrimental effects of industrial contamination might be regarded more favourably by industrial organisations.

However the Review team considers that one of INCA’s major responsibilities to society consists in introducing innovative technologies and in contributing to the development of the chemistry of the future. Therefore INCA needs to gain the confidence and goodwill of industry by being simultaneously active and responsive to their real needs. One possibility is to invite industry representatives to participate in specialised discussion groups organised by INCA’s Scientific Committee as well as in the Quality Review teams. Another possibility is to use the new important role of INCA in the management of abandoned industrial facilities and converting industrial sites to new functions. INCA might consider discussing its role with relevant sectors of industry in order to increase mutual trust.

INCA needs also to develop strategic allegiances with relevant public authorities and this includes not only the MIUR but also the Ministry of Environment and the Ministry of Economy. By considering the level of expertise available in the network INCA should emerge as the main scientific adviser of government in its areas of activity. Perhaps INCA should consider ways of better advertising its capabilities, for instance by organising a well designed book/brochure with its technological offer, including areas of expertise, contacts with experts and good examples of previous good practice and relevant services to society in general and to the industry in particular.

The Review team reiterates its former recommendation that INCA should establish an industrial liaison office, responsible for research contracts between industries and the member research units.

That INCA must make efforts to increase and diversify its financial support.

The Review team recognises that INCA has developed strong efforts to increase and diversify its financial support. The staff at the Roma office and having some people able

to follow INCA's proposals either within Italian ministries or in Brussels, seem very good ideas that INCA needs to pursue and develop. The fact is that INCA should be able to win tenders for contracts just because it is a well-structured and developed network of university research centres is one important contribution to the added value of the network. On the other hand, participation in large interdisciplinary projects will certainly increase the cohesion of the network as well as the sense of "belonging" and loyalty of the units towards INCA. However the Review team recommends that INCA analyses the administrative personnel's lack of proficiency in foreign languages and regularly reviews the need for and numbers of staff members.

In particular INCA needs to use the vast resources of its research units to increase participation in EU funded programmes. The well trained staff from the Roma office can give an invaluable contribution to this objective, by helping researchers in writing research proposals, fostering contacts with international groups (and this needs good proficiency at least in English) and providing timely information to INCA's members about European programmes or calls for partnerships. The Review team reiterates its former recommendation that this office keeps an updated data basis of Italian researchers in chemistry for the environment as well as of their research programmes.

The Review team also reaffirms that to fulfil its potential INCA needs to have enough resources at its disposal for the establishment of a research policy and this implies that MIUR must make available: a certain number of resources, including scholarships for Ph.D. students, and for postdoctoral researchers, both Italian or foreign, as well as an earmarked sum for financing strategic multidisciplinary research (a recipe against fragmentation and dispersion of research objectives) and for matching the funds made available through European research projects.

That INCA continues to develop specialist facilities that are made available to its members.

INCA has followed the Review team's previous recommendation for the development of its policy of common laboratories by allocating financial resources for the establishment of a network of common laboratories with specialist or expensive items of equipment.

In 1998 the Review team recommended that responsibility for running those centres must be clearly defined (a single research unit will take full responsibility), and that control mechanisms have to be created in order to check and to improve the quality of their services. The Committee also recommended that INCA should keep a record of the activity of the common laboratories as well as of the degree of satisfaction regarding accessibility to researchers and quality of service, while keeping a careful balance between time allocated to researchers and time sold to outside constituencies.

The present difficulties observed at the Catania laboratory would have been prevented if INCA had followed more closely the Committee's recommendations. Therefore INCA urgently needs to approve precise regulations that clearly define responsibilities for the proper operation of its laboratories, and measures to be taken whenever the activity of those laboratories does not satisfy their clients, including INCA's research units.

As for the Catania laboratory we strongly recommend that INCA appoint an ad hoc committee with representatives for the Sicilian units with an interest in using the available equipment and with the clear objective of finding a solution for the problem until the end of the year. If this fails then more drastic measures should be contemplated. The Review team will be available if required to help with the analysis of the situation and to offer advice on alternative action.

INCA might also consider the possibility of establishing a system of an "ombudsman" for the clients of its laboratories with the main task of representing the interests of INCA's researchers and calling the attention of management whenever well-grounded complaints or deficient operation are detected.

That INCA addresses the issues of the use of new technologies, data management, intellectual property rights and patents.

The Review team also recommends that INCA addresses some items that were already referred to in the 1998 report, such as developing a computerised system for retrieval of scientific information related to the field of chemistry for the environment and addressing the problem of intellectual property, including the case of patents originating from joint research projects.