Independent Evaluation

# ICS Trieste

## International Centre for Science and High Technology (ICS)

## Trieste, Italy



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO EVALUATION GROUP

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# Acknowledgement

The evaluation team would like to thank all those who contributed to the preparation and realization of the mission. We hope that this report, covering our findings, conclusions and recommendations, will be instrumental in discussions as regards (i) the project results, (ii) its follow-up and (iii) its possible replication and expansion, both in Italy and elsewhere.

# Contents

# Acronyms and abbreviations

| | |
|---|---|
| ASG | Assistant Secretary General |
| CBM | Cluster for Biomedicine |
| COMFAR | Computer Model for Feasibility Analysis and Reporting |
| CP | Cleaner Production |
| DCs | Developing Countries |
| DST | Decision Support Tools |
| EU/FELICS | Free European Life-science Information and Computational Services |
| GEF | Global Environment Facility |
| GF | Global Forum |
| ICAMT | International Centre for the Advancement of Manufacturing Technology |
| ICGEB | International Centre for Genetic Engineering and Biotechnology |
| ICHET | International Centre for Hydrogen Energy Technology in Istanbul |
| ICM | Institute of Commercial Management |
| ICS Trieste | International Centre for Science and High Technology, |
| ICSHP | International Centre for Small Hydro Power in Huangzhou (China) |
| ICT | Information and Communication Technology |
| ICTP | International Centre for Theoretical Physics |
| IPR | Intellectual Property Right |
| ISAS | International School of Advanced Studies |
| ISC | International Scientific Committee |
| ITCs | International Technology Centres |
| ITPOs | Investment and Technology Promotion Offices |
| LDCs | Least Developed Countries |
| MD | Managing Director |
| MDGs | Millennium Development Goals |
| MTPF | Medium-Term Programme Framework |
| MoU | Memorandum of Understanding |
| NCPC | National Cleaner Production Centre |
| NIS | National Innovation System |
| OECD | Organization for Economic Cooperation and Development |
| OSL/EVA | UNIDO's Evaluation Group |
| POPS | Persistent Organic Pollutants |

| | |
|---|---|
| PTC | UNIDO's Programme Development and Technical Cooperation Division |
| RBM | Resource-Based Management |
| R & D | Research and Development |
| SC | Steering Committee |
| SDT | Science for Development Forum |
| SFO | Senior Fellowships Officer |
| SISSA | International School for Advanced Studies, Trieste |
| SMART | Self-Monitoring, Analysis and Reporting Technology |
| SMEs | Small and Medium Enterprises |
| SRT | Science, Research and Technology Transfer |
| TC | Technical Cooperation |
| TWAS | Academy of Sciences for the Developing World |
| UNDAF | United Nations Development Assistance Frameworks |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNIDO | United Nations Industrial Development Organization |

# Glossary of evaluation related terms

| | |
|---|---|
| ***Conclusions*** | Conclusions point out the factors of success and failure of the evaluated intervention, with special attention paid to the intended and unintended results and impacts, and more generally to any other strength or weakness. A conclusion draws on data collection and analyses undertaken, through a transparent chain of arguments. |
| ***Effectiveness*** | The extent to which the development intervention's objectives were achieved, or are expected to be achieved, taking into account their relative importance. |
| ***Efficiency*** | A measure of how economically resources/inputs (funds, expertise, time, etc.) are converted to results. |
| ***Impacts*** | Positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended. |
| ***Indicator*** | Quantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect the changes connected to an intervention, or to help assess the performance of a development actor. |
| ***Institutional development impact*** | The extent to which an intervention improves or weakens the ability of a country or region to make more efficient, equitable, and sustainable use of its human, financial, and natural resources, for example through: (a) better definition, stability, transparency, enforceability and predictability of institutional arrangements and/or (b) better alignment of the mission and capacity of an organization with its mandate, which derives from these institutional arrangements. Such impacts can include intended and unintended effects of an action. |
| ***Lessons learned*** | Generalizations based on evaluation experiences with projects, programs, or policies that abstract from the specific circumstances to broader situations. Frequently, lessons highlight strengths or weaknesses in preparation, design, and implementation that affect performance, outcome, and impact. |
| ***Logframe*** | Management tool used to improve the design of interventions, most often at the project level. It involves identifying strategic elements (inputs, outputs, outcomes, impact) and their causal relationships, indicators, and the assumptions or risks that may influence success and failure. It thus facilitates planning, execution and evaluation of a |

| | |
|---|---|
| | development intervention. Related term: results based management. |
| ***Outcome*** | The likely or achieved short-term and medium-term effects of an intervention's outputs. Related terms: result, outputs, impacts, effect. |
| ***Outputs*** | The products, capital goods and services which result from a development intervention; may also include changes resulting from the intervention which are relevant to the achievement of outcomes. |
| ***Recommendations*** | Proposals aimed at enhancing the effectiveness, quality, or efficiency of a development intervention; at redesigning the objectives; and/or at the reallocation of resources. Recommendations should be linked to conclusions. |
| ***Relevance*** | The extent to which the objectives of a development intervention are consistent with beneficiaries' requirements, country needs, global priorities and partners' and donors' policies.<br>Note: Retrospectively, the question of relevance often becomes a question as to whether the objectives of an intervention or its design are still appropriate given changed circumstances. |
| ***Results*** | The output, outcome or impact (intended or unintended, positive and/or negative) of a development intervention. Related terms: outcome, effect, impacts. |
| ***Sustainability*** | The continuation of benefits from a development intervention after major development assistance has been completed. The probability of continued long term benefits. The resilience to risk of the net benefit flows over time. |

# Executive Summary

## Introduction

The International Centre for Science and technology (ICS) was established by UNIDO, in 1988, and is financed from a Special Purpose Contribution by Italy, to the Industrial Development Fund. The Centre's objective is to "*develop and strengthen the scientific and technological capabilities of developing countries by the creation and application of scientific knowledge".* Since 1996, the operations of the ICS are subject to an Institutional Agreement between the Government of Italy and UNIDO. The Headquarters of the ICS is located in Trieste, Italy.

The evaluation forms part of the OSL/EVA Work Programme for 2008/2009, which encompasses a Thematic Evaluation of International Technology Centres. An evaluation had also been requested by the ICS Steering Committee. It was carried out between March and June 2009 by a team of internal and external evaluators and included a visit to Trieste and an internet survey of ICS beneficiaries.

## Relevance

The evaluation team found that the ICS is relevant to developing countries and that the objective of strengthening scientific and technological capabilities remains pertinent. The ICS is, moreover, relevant to the Government of Italy as the support to the ICS fits into its development cooperation objectives and, in addition, contributes to the strengthening of the "Trieste System". The relatively modest and, over the years, significantly eroded budget does not indicate a strong commitment but, on the other hand, the contributions have been long-term and stable.

The ICS is also found to be relevant in principle to UNIDO as some activities are related to UNIDO's thematic areas of industrial development, energy and environment but there are also areas or interventions that are not in line with the UNIDO mandate. The UNIDO Medium Term Programme Framework 2010-2013 signals the need to provide access to technical know-how in order to promote pro-poor and inclusive growth and the ICS can undoubtedly contribute to this. The ICS has in the past, been an organizer of many expert group meetings, contributed to the fulfilment of UNIDO's global forum function and been developing technical capacities and knowledge but the relevance to UNIDO could be enhanced through a closer linkage of ICS interventions to UNIDO's thematic priorities, the programmes of the technical branches and to the expanded UNIDO network of international technology and investment promotion centres.

The mandate of promoting access to know how and technology for industrial and economic development is thus found to be relevant but this relevance could be enhanced through an increased demand orientation and more attention to responding to developing countries' identified needs and priorities. So far, the immediate relevance of implemented and planned activities, to the industrial sector in developing countries is not evident. The evaluation team also noticed that the ICS has no other UNIDO member country contributing to its budget.

## Efficiency and management

As part of UNIDO, the management and the day-to-day operations of the ICS are subject to the same legal and administrative requirements as other offices and projects. The UNIDO headquarter-based management was found to be substantial and adequate. The secondment of an Administrative Officer from headquarters to the ICS has ensured more efficient implementation and has contributed to an increased knowledge and awareness of UNIDO procedures and UNIDO programmatic activities. The new ICS management (2007 onwards) has also made serious efforts to improve strategic management and planning, many administrative and programmatic changes have been introduced and long-foreseen steering and advisory functions been put in place. Structural changes are still being implemented and 2009 is considered as a year of transition.

ICS has and is delivering a large amount of outputs; training programmes, Expert Group Meetings, workshops, publications and fellowships. The evaluation team found that these outputs have generally been delivered in a cost-effective manner and that the close collaboration with and support from other institutions of the Trieste System have contributed to this. Still, the budget and staffing of ICS seems to be too small in relation to its Strategic Plan and Work Programme.

## Effectiveness

The impact of the ICS on industrial development is found to have been limited. This is partly due to the limited resources at its disposal but also due to a weak linkage with the industrial sector in developing countries and the lack of a ICS strategy for technology transfer. The effectiveness of ICS in terms of delivering purely scientific outputs and achieving outcomes will benefit from its new strategy and in particular on a reduced number of research areas. Still there is a need for an increased results-focus in order to develop and strengthen the scientific and technological capabilities of developing countries and contribute to industrial development.

Neither, has the potential of the ICS to contribute to capacity building in developing countries been fully exploited. Reasons are a dispersed research portfolio, the absence of a partnership strategy and the fact that the limited ICS

resources have been spread too thinly. It has mainly been the chemistry area that has produced high level scientific outputs but their effects in terms of industrial development and capacity building are not known. The environment and high technology areas have been more active in the field of technology transfer and middle-level research (e.g. collecting state of the art information on certain scientific issues and conducting technology management trainings) but also here information on effects are missing.

A major activity of the ICS has been to promote scientific research and provide opportunities to researchers and scientists of developing countries to develop their knowledge and get exposure to scientific programmes. Generally, the fellowships have been highly appreciated and valuable knowledge has been imparted. It is not known, however, to what extent research outputs and trained scientists actually benefit ICS partner institutions and the industrial and economic development of recipient countries or contribute to a more sustainable environment.

## Sustainability

The sustainability of the ICS depends to a large extent on the future direction of the Institution. A more independent ICS with a strong focus on in-house research is being envisaged but this will require a substantial increase of external funding to create the "critical mass" necessary for internationally recognized research. Another option is an ICS, more integrated into UNIDO and with interventions linked to the organization's technical cooperation and global forum programmes, in need of training or research. This would demand less resources and create synergies.

With the long-term and continuous funding from the Italian Government, the ICS can be defined as organizationally and financially sustainable. There is still, however, a need to build up the technical capacity in some core areas in order to be technically sustainable.

## Conclusions

The ICS is a relevant institution but its direct usefulness for developing countries should be reinforced. So far, there are limited synergy effects from ICS being part of UNIDO and there is limited alignment to UNIDO's thematic priorities and some uncertainties as to whether ICS contributes to the achievement of objectives in partner countries. This does not mean that ICS areas of interventions are not relevant but it poses some questions as to the value added, the two institutions are providing to each other. Both the staff of the ICS and of UNIDO's technical branches could, more pro-actively, pursue a deeper and more constructive

cooperation. There is also a need, for the ICS, to demonstrate concrete results and its usefulness to all stakeholders.

This would entail a closer alignment to UNIDO's strategic objectives and thematic priorities. Another, probably equally valid alternative, would be for the ICS to promote its own research agenda and move towards becoming a fully independent research institution. Thus, in order to be fully efficient and effective, the ICS needs to align to UNIDO's thematic priorities or become independent, in both cases the needs and priorities of developing countries should be in the forefront.

## Recommendations

*Recommendations to UNIDO/ICS with the assumption that ICS will continue to be part of UNIDO:*

- The main objectives of the ICS should be aligned to those of UNIDO, focusing on knowledge and technology transfer to industry and on capacity development;

- The ICS Strategy and Programme should be aligned to developing country needs and priorities and specifically those of the industrial sector;

- The ICS Work Programme should be more focused in order to avoid that resources are spread thinly;

- More emphasis should be given to the broker function of the ICS (processing and dissemination of existing scientific information), as opposed to research-function (generation of new scientific knowledge);

- A strategy for capacity building should be developed and implemented for key institutional partners in developing countries;

- The ICS should become more international diversifying and expanding the network of partners and contributors beyond Italy ;

- Fellowships should be planned and implemented so that they can contribute to a process of change and development;

- The ICS should be more involved in bridging the science-industry gap in client countries;

- The International Scientific Committee should have representatives from the industrial sector, including from Industrial Research and Development (R&D) organizations;

- The ICS Trieste should develop its theories of intervention: a clear intervention logic should be developed for all ICS programmes ad projects and the expected impact should be clearly stated;

- ICS should adopt RBM and results should be monitored and reported on;

- UNIDO should incorporate the ICS in its organizational structure, planning and strategy documents;

- UNIDO should take greater advantage of ICS facilities: for example, the ICS facilities could be used for UNIDO Summer Universities;

- South/South cooperation should be encouraged; and

- There should be an attempt to expand membership and donors and to develop longer-term funding arrangements.

*Recommendations to UNIDO/ICS with the assumption that ICS will, in the medium term, develop into an independent research-focused institute:*

- A UNIDO project document should be prepared to describe the cooperation between UNIDO and ICS from now to independence. This should include a clear exit strategy and the activities and outputs necessary to transferring ICS into an independent inter-governmental organization.

- To increase overall efficiency of the ICS overhead costs should be reduced to the extent possible and administrative procedures should be made more congruent with the institutional nature of the ICS

# 1 Introduction

The evaluation of the International Centre for Science and Technology (ICS) was requested by UNIDO management and was included in the 2008/2009 Work Programme of the UNIDO Evaluation Group (OSL/EVA). An evaluation had also been recommended by the ICS Steering Committee, at its meeting in April 2006. The evaluation was carried out as stand-alone project evaluation but findings will, in addition, serve as inputs to the Thematic Evaluation of International Technology Centres, also part of the OSL/EVA Work Programme for 2008/09.

The ICS, located in Trieste, Italy, is in terms of budget and staffing, one of the largest International Technology Centres in the UNIDO Network and it was, for this reason, seen as appropriate to include the ICS Trieste in the in-depth evaluations carried out within the Thematic Evaluation. Moreover, the ICS had not been evaluated since 1991. It had, however, been subject to various reviews.

The objectives of the ICS are to *develop and strengthen the scientific and technological capabilities of developing countries in the creation and application of scientific knowledge*[1]. It is to function as a centre of excellence in research and training, addressing priorities of developing countries, analogous to other centres of the "Trieste System", operating in the fields of physics and mathematics (ICTP) and life sciences (ICGEB). The ICS Management regards 2009 as a year in transition towards a stronger research orientation and expects a new organization to be in place in 2010.

The purpose of the evaluation was to enable the Government of Italy and UNIDO to have up-to-date information regarding the relevance, efficiency, effectiveness, sustainability and impact of the ICS. The evaluation was primarily a forward-looking exercise, assessing the past and potential performance and results of the Institution and its continuous relevance and tried to identify lessons learned to guide the future orientation of the ICS. It was undertaken between March and June 2009 by a team of internal and external evaluators.

[1] Institutional Agreement between the Government of Italy and the United Nations Industrial Development Organization concerning the institutional arrangements for the International Centre for Science and High Technology

# 2
# Methodology and scope

The evaluation was conducted in accordance with the Terms of Reference (ToR) for the evaluation and in compliance with UNIDO's Evaluation Policy and the Technical Cooperation Guidelines. The ToR is attached as Annex I. It assessed the achievements of the ICS against its objectives and outputs, established in the Institutional Agreement (1993) and in annual Work Programmes and included a re-examination of the relevance of the objectives and of the design. It also identified factors that have facilitated or impeded the achievement of the objectives.

The evaluation team analyzed information from various sources including ICS programmatic documents, strategies, action plans and work programmes, ICS publications and research reports, survey data, reports of Expert Group Meetings, workshops and training programmes, ICS training material, feed-back forms of participants in workshops/seminars, reports from fellowship holders and minutes of meetings of the International Scientific Committee and of the ICS Steering Committee. A list of documents consulted is provided as Annex II. There were also visits to the ICS internet and intranet sites.

In late 2008/early 2009 ICS undertook a self evaluation exercise. The reports of the self evaluation were made available to the evaluation team before the evaluation started and functioned as major inputs.

Moreover, interviews were held with various stakeholders such as ICS and UNIDO staff members, representatives of the Italian Government and of partner institutions in Trieste and with ICS beneficiaries, including a group meeting with ICS fellows. In order to facilitate information collection and analysis, interview guidelines were developed and used during the interviews. A full list of people consulted is provided in Annex III.

A web-based survey was conducted among the 80 most recent fellows of ICS and covering all fellows of the last two years (2007 and 2008). The response rate was 43%. In addition information on fellows was obtained from the ICS website and specific reports and the main results of the Survey were validated. The evaluation team also visited partner institutions of the ICS in Trieste (e.g. University of Trieste, CBM, ISAS, Elettra) and other international research institutions (ICTP, ICGEB, TWAS) in order to assess actual or potential cooperation and synergies with these institutions and draw from the experience gained by them, in order to identify best practices. Annex IV entails the survey instruments and analysis of the responses.

The analyses included a review of relevant UNIDO policies and strategies, management mechanisms applied (in particular in regards to planning and monitoring) and project specific conditions. While maintaining independence, the evaluation was carried out based on a participatory approach and seeking the assessments of all parties.

Information obtained through interviews was cross-validated with data contained in reports and triangulated with those of other interviewees and information from other sources, such as the Survey and ICS reports. Reliability and validity of information were generally found to be good. Preliminary findings were discussed with the ICS management at the end of the field mission and the draft report was shared for comments and factual validation with ICS and UNIDO headquarters staff. The final report will be presented to ICS, UNIDO HQ staff and to the donor.

# 3
# The ICS Trieste – Background information

## History and Mandate

The ICS was established in 1988 with the objective to promote high-level research and develop and strengthen scientific and technological capacities of developing countries in the creation and application of scientific knowledge. The objective was to be achieved by providing scientists from developing countries with training and access to equipment and facilities for research, related to the development of a science-based industry. The activities and interventions envisaged were training, research, workshops, scientific meetings, a scheme of visiting scientists (fellows) and the transfer of technology.

The ICS is financed through a Special Purpose Contribution, by the Government of Italy to the Industrial Development Fund. While the Institutional Agreement clearly expressed the expectation that other donors would contribute to the ICS, so far, there has been no other UNIDO member country contributing. The annual Italian funding was initially fixed at Italian Lira 7 billion (at that time corresponding to around US$ 2.5 million and presently to € 3.6 million. The ICS operated in a preparatory phase from 1988 until 1996, when an Institutional Agreement, see below, between UNIDO and the Italian Government entered into force.

The ICS is administered as a project and subject to UNIDO's *Staff Regulations and Rules* and *Financial Regulations and Rules,* as well as to other administrative instructions of UNIDO. It is also guided by specifically designated administrative instructions, provided in the ICS Administrative Manual approved by the UNIDO Executive Board in March 2008. However, this manual is considered a "living document" and is still being revised. ICS was established as a subsidiary body of UNIDO by a decision of the Industrial Development Board in 1991 (IDB.8/Dec.11), endorsed by the General Conference (GC.4/res.14), which also proclaimed that the ICS and its activities should be financed exclusively through voluntary contributions from the Government of Italy and any additional voluntary contribution made to UNIDO for this purpose. The governing bodies of UNIDO also endorsed the conclusion of the Agreement with the Government of Italy.

According to its original mandate, the ICS was to function as a centre of excellence for training and research in science and high technology[2] . However, this was not confirmed in the **Institutional Agreement**, signed in 1993, between the Government of Italy and UNIDO, which rather specifies that the ICS is

[2] See UNIDO General Conference 4, Resolution 14

established as a scientific institution with autonomy. The Agreement entered into force in 1996, following the enacting of a law by the Italian Parliament, providing funding for the ICS. According to the Agreement, the transfer of applied science and high technology from developed to developing and transition economy countries would contribute to economically, environmental and socially sustainable industrial development. The Institutional Agreement, moreover, provides the essential framework for the functioning of the ICS. The intention was to establish three separate institutes: the International Institute for Pure and Applied Chemistry, The International Institute for Earth, Environmental and Marine Sciences and Technologies and the International Institute for High Technology and New Materials. This planned set-up, with activities in Trieste and Venice, never materialized and the ICS was established as one institute with different scientific programmes, in the foreseen areas, mentioned above.

It is obvious that the ICS as envisaged by its "founding father"; the Nobel Price laureate Mr. Abdus Salam, was a more ambitious institution, in terms of scope and activities, than actually materialized and was feasible in terms of allocated resources. Nevertheless, the ICS objective and mandate was never re-defined to fit the actual resources (financial as well as human) at hand. Up to now, the ICS has primarily been involved with technology transfer coupled with some research activities, mainly in the field of applied chemistry and Medicinal aromatic plants.

At the time of the evaluation, the ICS was governed by the "ICS Plan of Action for the Future" and the "ICS Action Plan for 2009-2011". The ICS Plan of Action for the Future provided an increased focus on research and on the development of research capacities within the ICS, as opposed to a previous vision of undertaking research in collaboration with universities. The 2009 Work Plan focuses on four designated core scientific programmes, which are;

- Rational Drug Design
- Next Generation Biofuels
- Geothermal Energy
- Nanotechnology

In addition to the four core areas, there is an E-learning sub-programme with an E-learning project implemented by the Office of the Managing Director. A Plan of Action 2010 to 2012 and a 2010 Work Programme will be prepared during 2009.

Over the last few years, there have been considerable efforts by the ICS management to reinforce the strategic orientation of the ICS and to strengthen the Institution. It should be kept in mind that the existing Managing Director has been in office for a relatively short period, that the Rector was nominated only in 2007 and that change processes take time to implement. It was noticed that the present ICS management intends to increase the results-orientation of the activities and programmes and that changes in this direction are foreseen in future planning and reporting documents.

There is also an desire articulated by both sides to develop more collaboration of ICS with UNIDO's technical branches and to align to UNIDO thematic priorities. At the same time, the ICS is somewhat constrained by its original mandate, as

the Institutional Agreement has been passed as an Italian Law and cannot easily be amended and by the resources at its disposal.

## Location and staffing

The ICS is located in the Area Science Park in Trieste and the plan is to move into larger premises, within the same area, during the summer of 2009 (the tentative date was June 2009). The new premises will enable the establishment of research laboratories; wet labs for catalysis and synthesis and the hosting of an advanced computer facility with silicon graphics and new servers.

The ICS has 20 staff members, out of which three are staff with responsibilities in the scientific area, and is headed by a Managing Director. From August 2006, there have been two staff members consecutively seconded by UNIDO. The first secondee arrived in August 2006 to take up the position of Director of Administration and Programme Coordinator and remained in this position until July 2007 when he was, in addition, designated as Officer in Charge of the ICS. In June 2008, this arrangement ceased with the new Managing Director being appointed and starting his term. The second UNIDO secondee arrived towards the end of 2008 to take up the function of Administrative Manager and is, in addition, responsible for funds mobilization.

The largest ICS area of activity; Pure and Applied Chemistry is endowed with two professionals and one administrative staff and at the time of the evaluation three consultants were contracted. The consultants either work from the ICS premises or, on a part-time basis, from their regular workplace, usually an Italian university. Generally, internal staff are being complemented by visiting fellows, who are usually researchers from developing countries.

The employment conditions of the ICS staff members are governed by its project status and the Institutional Agreement and contracts are not issued beyond a twelve month period, due to the feature of annual contributions from the Italian Government. The professional staff members are all under L-series UNIDO contracts. The possibility of a guarantee fund for long-term appointments and increased job security is being looked into.

An **ICS Rector** was nominated in April 2007 and provides services to the ICS but this position is considered as an honorary rather than a staff position. The International Scientific Committee (ISC) and its Chair, the ICS Rector are to provide overall scientific direction to the ICS. Among other things, the ICS Rector has chaired a Vienna Expert Group meeting about the future directions of the ICS, made substantial contributions to the development of the ICS Action Plans and had a primordial role in identifying members for the ISC. The ICS Rector has also been promoting the alignment of the ICS to its original mandate of a research-oriented centre of excellence.

The **International Scientific Committee**, although foreseen in the Institutional Agreement, was not established until August 2008 and met for the first time in September 2008. It is composed of 10 high level scientists from developed and developing countries. The function of the Scientific Committee is to validate the

work carried out by the ICS, provide scientific guidelines for the formulation of work plans. The International Scientific Committee members should also propose ICS fellows and assist in organizing ICS events.

## Budget and financial arrangements

The ICS is funded by the Government of Italy through an annual special purpose contribution, presently amounting to euro 3.6 million, including 5 per cent UNIDO support cost. Financial statements have been issued on a yearly basis. The minimum budget was established in 1988 and has since, due to inflation and the introduction of the euro, been eroded to about half its real value. The Agreement states that the level of contribution shall be reviewed every year but this has not been the case.

Generally, with a high level of predictability, the Government contribution has been received by the ICS late in the year (September/October) causing disturbances in ICS planning and processes. In 2009 the contribution, for the first time, arrived relatively early, in April. Due to accumulated savings, the actual approved budget, at the disposal of the ICS for 2009, is euro 5 million and this is also expected to be the amount for the next few years.

Table 1 below provides an overview of the ICS 2009 budget and comparisons with 2008 expenditures. The budget for 2008 amounted to about euro 6 million with actual expenditures of about euro 4 million while the budget for 2009 has, as mentioned, been established at euro 5 million. The budget for 2008 was thus considerably higher than actual expenditures and the budget for 2009 is at a lower level than for the previous year. Many of the differences can be explained by the transitional phase of the ICS and the costs involved in the establishment of new laboratories.

Out of the euro 5 million 2009 budget, more than 12,5 per cent is allocated to the Office of the Managing Director and 24 per cent to Administration and Information and Communication Management. As concerns allocation for the core programme areas, the largest share (about € 1 million) is allocated to Rational Drug Design, followed by Next Generation Biofuels, Geothermal Energy and Nanotechnology and E-learning. Whereas

**Table1**: **ICS/UNIDO 2009 budget compared with 2008 expenditures**

| **Per budget line**: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Budget line* | *Budget-line Description* | *2008 allocated budget (in K €)* | *2008 allocated budget rev. ZB (in K €)* | *Total expected expenditures 2008 as per Agresso 14 Nov. (in K €)* | *Total expected expenditures 2008 as per best estimate* | | *Budget 2009* | |
| | | | | | *in K €* | *percentage of total* | *in K €* | *percentage of total* |
| 1100 | Professiona | 1,225 | 1,445 | 1,033 | 1,10 | 26.5 | 1,34 | 26.8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | l staff | | | | 0 | | 0 | |
| 1150 | Int. experts | 359 | 366 | 239 | 239 | 5.8 | 326 | 6.5 |
| 1300 | Support personnel | 716 | 731 | 657 | 716 | 17.2 | 677 | 13.5 |
| 1500 | Project travel | 348 | 331 | 162 | 190 | 4.6 | 116 | 2.3 |
| 1600 | UNIDO staff travel | 112 | 112 | 20 | 25 | 0.6 | 45 | 0.9 |
| 1750 | National experts | 461 | 451 | 277 | 290 | 7.0 | 597 | 12.0 |
| 2100 | Subcontracts | 347 | 187 | 18 | 18 | 0.4 | 60 | 1.2 |
| 3100 | Fellows | 1,023 | 893 | 449 | 490 | 11.8 | 416 | 8.3 |
| 3500 | Meetings | 885 | 810 | 535 | 695 | 16.7 | 470 | 9.4 |
| 4300 | Premises | 10 | 160 | 142 | 142 | 3.4 | 200 | 4.0 |
| 4500 | Equipment | 313 | 333 | 175 | 190 | 4.6 | 668 | 13.4 |
| 5100 | Sundries | 194 | 174 | 47 | 60 | 1.4 | 75 | 1.5 |
| 5500 | Hospitality | 10 | 10 | 1 | 1 | 0.0 | 10 | 0.2 |
| | **TOTAL** | **6,003** | **6,003** | **3,755** | **4,156** | 100.0 | **5,000** | 100.0 |
| **Per area:** | | | | | | | | |
| | Area | | | | | | | |
| | CHM | 1,750 | 1,676 | | 1,155 | 27.8 | 1,671 | 33.4 |
| | ENV | 1,480 | 1,407 | | 1,147 | 27.6 | 628 | 12.6 |
| | HTM | 1,618 | 1,545 | | 630 | 15.2 | 876 | 17.5 |
| | OMD | 485 | 595 | | 501 | 12.0 | 622 | 12.5 |
| | ICM | 249 | 249 | | 251 | 6.0 | 249 | 5.0 |
| | ADM | 421 | 531 | | 472 | 11.4 | 954 | 19.0 |
| | **TOTAL** | **6,003** | **6,003** | | **4,156** | 100.0 | **5,000** | 100.0 |

*Source:* UNIDO and ICS databases, March 2009

the Nanotechnology laboratory is specifically budgeted for in the 2009 Work Programme,
there is no equivalent budget figure for the wet laboratories to be established for the chemistry programme but there is a budget specification of € 593 000 under operational costs. The fellowship budget for 2009 is almost half of what was allocated in 2008, justified by the transitional nature of the year.

The main budget posts are professional staff and experts (about euro 2.3 million in 2009) followed by support personnel, meetings and fellows. The 2009 budget has, as mentioned above, a relatively large equipment component. Overall, scientific related inputs and activities amount to 64 per cent of the ICS budget while administration, information and communication and management account for about 36 per cent.

In 2007 and 2008 the ICS budget was evenly spread over the three core scientific areas. This changed in 2009, with a substantial increase for the area of applied chemistry, partly due to the purchase of equipment for the new laboratory.

# 4
# The ICS context

The context of the ICS influences the relevance of its activities, its effectiveness and efficiency. The following is a description of the ICS environment from an organizational-, scientific & research- and an international development point of view.

## The organizational context

As mentioned above, ICS is operating within the legal framework of UNIDO as a scientific institution with autonomy and receives its funding through UNIDO. It is principally governed by the Institutional Agreement between the Government of Italy and UNIDO. The Italian support to the ICS was codified in a national law which refers to the Agreement. This has implications for the ICS as modifications of the yearly budget and other major changes would require approval by the Italian Parliament.

The Agreement does not establish any technical responsibilities of UNIDO, limiting its role to the administrative and financial management of the Italian contributions to the ICS and the overall approval of the ICS programme and budget. The substantive and technical input from UNIDO to ICS (and vice versa) is thus not specified in the Agreement.

## The scientific and research context

The Trieste area has a high concentration of scientific and research institutions and many of these have an international orientation and are related to the UN System:

a) the International Centre for Theoretical Physics (ICTP). The ICTP is linked to UNESCO and the International Atomic Energy Agency (IAEA). The Director of the ICTP is renowned physicist.
b) the International Centre for Genetic Engineering and Biotechnology (ICGEB), formerly linked to UNIDO, is now an independent international organization with it's own set of member states[3] and affiliated centres. The ICGEB applies UN rules and procedures (staff categories, pension system, external auditing, etc.) and is classified as an Intergovernmental

[3] 79 Signatory States, 59 Member States, 3 Components: Trieste (Italy) - New Delhi (India) and Capet Town (South Africa) a network of 39 Affiliated Centres (source: ICGEB brochure)

Organization under the United Nations Common System. The director of the ICGEB is a renowned scientist in the field of molecular biology.

c) the Academy of Sciences for the Developing World (TWAS), an autonomous international organization, was founded in 1983 by a group of scientists from the South. It does not carry out research on its own, but rather acts as a forum for scientists from the developing world.

Together with two national research institutions with an international vocation – the International School of Advanced Studies (ISAS) and the Synchrotron Elettra (a multidisciplinary laboratory specialized in synchrotron radiation and its use in the science of matter) – the above mentioned international institutions and the ICS form the so called "Trieste System", which, together with its history is described in Diagram 1.

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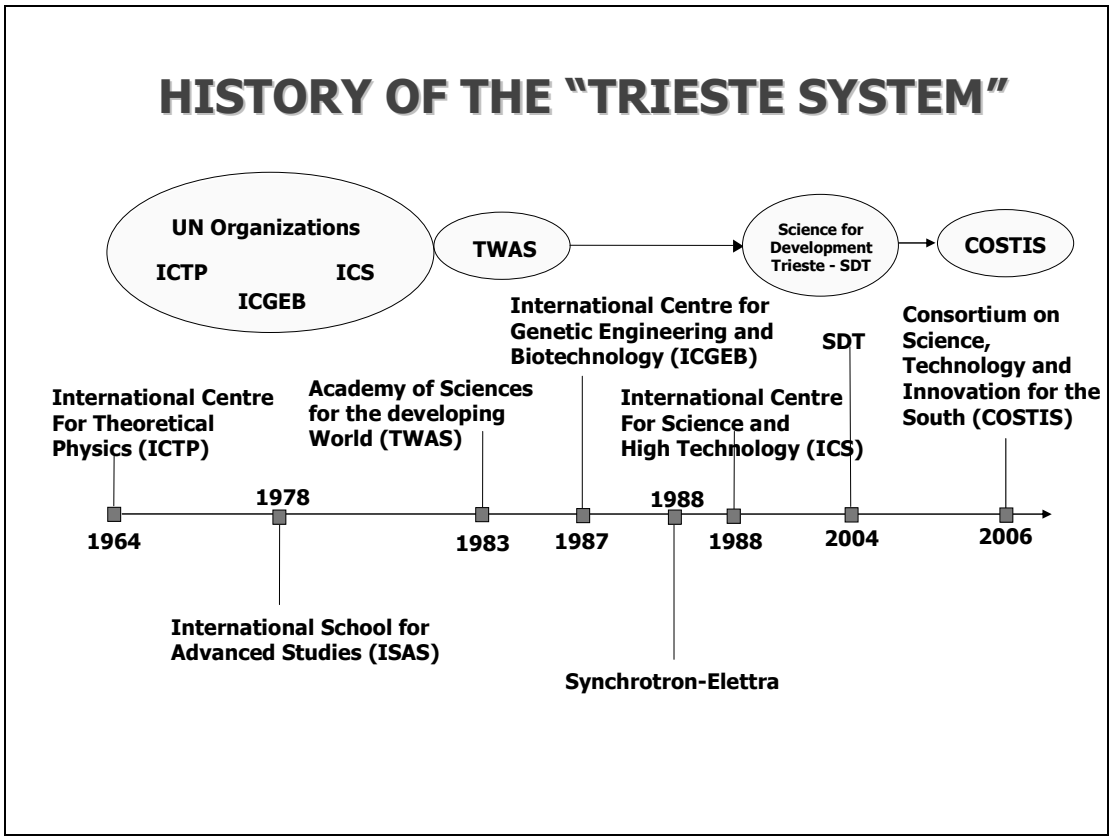
**Diagram 1 – Trieste System**




*Source:* Background papers prepared for the UNIDO, Expert Group Meeting, New Areas of Activity for the ICS, May 2007

The Trieste System can be regarded as an informal network of institutions. At the same time, in 2004, the Science for Development Forum (SDT) was founded to strengthen relations among the institutions and several meetings have been held since. Nevertheless, the Trieste System does not have an overarching

organizational or management structure. Still, efficient and effective collaboration do take place.

Within the Trieste System, the ICS at present cooperates primarily with the ICGEB and with Elettra. Despite of this cooperation, the originally foreseen strong complementarities between ICS and ICTP and ICGEB have not emerged. The cooperation with Elettra also involves the Cluster for Biomedicine (CBM), a recently established public-private research institution,[4] which carries out research (genomics, bioinformatics, nano-medicine, proteomics, stem cells) with a view to possible industrial applications. The liaison with the CBM is an important element of the new strategy of the ICS to establish in-house enhanced research capacities. Another important partner of the ICS is the Area Science Park, a publicly funded research promotion agency that hosts scientific institutions, promotes technology transfer and investment, undertakes training and disseminates scientific knowledge. ICS itself is located within the AREA Science Park.

Several other core scientific partners of the ICS are not part of the Trieste System, for example the University of Trieste and other regional universities (Padua, Venice, Ferrara, etc). These partners primarily cooperate with the ICS by receiving fellows and offering consultancy services.

Over the years, the ICS has concluded about 50 agreements and Memoranda of Understanding (MOU) with different scientific and non-scientific institutions. The legal validity of these agreements remains in several cases uncertain since they were not signed in accordance with established UNIDO procedures[5].

## The scientific-industry context

Designating the ICS in the category of institutions that act at the interface of science and industry, the following types of institutions can be commonly found in developed and developing countries and thus serve as a reference for the ICS' own positioning.

Industrial Research Institutes are organizations which conduct in-house research that is specifically tailored to the needs of industry. For many industrial firms, these institutes are their interface to the world of scientific and technological knowledge.[6] Some of these institutes are engaged in research that is directly applicable to industry, mainly contract research, others have a more long-term and indirect focus. According to how 'applied' the research is, three broad categories of industrial research institutes can be distinguished:

- Industrial research associations often function as research institutes and are directly linked to industry and, in many cases, a particular sector. It is rather common that these institutes have been founded by representatives of the industrial sector they promote. Research in these institutes tends to be fairly

[4] 60% public (AREA Science park main owner, which is fully owned by national government), 40% private with a few larger companies
[5] Director General's Bulletin 53/Rev.1, UNIDO, 2006
[6] OECD (2007): Innovation and Growth. Rationale for an Innovation Strategy.

'hands-on', focusing on development, testing, training, product engineering and contract research. One example is the Research Institute Swerea in Sweden which provides advanced research and consultancy services to the manufacturing industry. The United Kingdom, as another example, features a whole series of these institutes for different industry sectors, ranging from automotive to paper and publishing. Most of these institutes are membership-based. An example for a developing country is the Peruvian Asparagus Institute which was founded by asparagus producers in order to consolidate their knowledge and develop research and training. UNIDO has, in the past, contributed to the establishment of industrial research associations/institutes in many developing countries.

- Institutes of applied research aim at promoting industrial development more widely. They are generally not membership-based, and they focus on mid- to long-term research. Often research activities are directly contracted by a company. In addition, research is conducted on more self-defined, long-term issues. A well-known example is the Fraunhofer Society in Germany, which undertakes applied research of direct utility to private and public enterprises. By developing technological innovations and novel systems solutions for their customers, the Fraunhofer Institutes reinforces the competitive strength of the economy in their region.
- Institutes of basic research with some industry relevance. These are generally universities or institutes of basic research such as the Max-Planck Society in Germany. These institutions focus exclusively on research and education. In the developed part of the world there has been a growing attention to 'the entrepreneurial university' engaged in national and local problem solving. These trends have led universities not only to rethink their research and educational programmes but also to set up new specific functions aiming at marketing intellectual property, at commercializing education through new MBA-programs and at networking with local and regional actors. Most European and US (engineering) universities have set up their own on-site industrial liaison or technology transfer offices.

The above types of institutions mainly work with companies which already have some degree of technological sophistication and absorptive capacity. Both factors are not always found in developing countries, where only a small segment can be constituted of technology competent enterprises and where there is only a small number of research & development (R&D) performing enterprises for which the institutes could be potentially useful.

In addition to industrial research institutes, there are organizations providing technology transfer services to businesses without doing in-house research. They are sometimes referred to as Innovation brokerage organizations. These institutions engage in a variety of activities, for example advisory and consultancy services, information provision and awareness raising, training activities, matchmaking services or activities to foster the mobility of human resources. Generally, these organizations act as brokers for university-industry relations on the level of the national or regional innovation systems.

In Europe, there are many examples of such 'brokerage institutions'. One example is the Enterprise Europe Network which offers a 'one-stop shop' to meet information needs of SMEs and other companies in Europe. Instruments include

business partnership search within technology and business cooperation databases and fast access to information on funding opportunities. In addition to general business support and technology transfer services, there are institutions focusing on the transfer of technology in a particular area. For example, the Euro Institute for Information and Technology Transfer in Environmental Protection, which was founded by professional associations to offer assistance to small- and medium-sized producers, service providers and operators in the energy, water and environmental sectors.

UNIDO itself runs a series of centres focusing on technology transfer services in specific areas, the so called International Technology Centres (ITC) and the ICS itself belongs to this group. Another example is the ICAMT- the International Centre for Advanced Manufacturing Technology in India. The main functions of this centre are the development of (and funds mobilization for) project proposals for the technological support to a number of industrial sub-sectors as well as the identification of international and national expertise for the projects. Other examples are the International Centre for Small Hydro Power (ICSHP) in Hangzhou, China, or the International Centre for Hydrogen Energy Technology (ICHET) in Istanbul, Turkey. Apart from ICS, all of the UNIDO International Technology Centres are located in developing countries.

An interesting example of and technology transfer agency in a developing country is Fundacion Chile, created in 1976 originally as a joint effort between the Chilean Government and the international firm ITT Corporation, but now largely autonomous. Fundacion Chile uses four main techniques in its technology transfer and dissemination work: (1) it creates and/or promotes innovative enterprises, almost always in association with companies or individuals; (2) it develops, adapts, and sells technologies to clients in the productive and public sectors and both within the country and abroad; (3) it fosters institutional innovations and incorporates new transfer mechanisms and (4) it captures and disseminates technologies to multiple users though seminars, specialized magazines, project assistance, and so on. Other technology brokerage institutions focus on a particular type of services. In most cases, on either licensing and patents or start-up and incubation services.

A good understanding of the characteristics of firms, their needs and of different support instruments is crucial for any technology transfer or innovation-related intervention to be effective. In the European context different types of support instruments are offered by various support initiatives and institutions. Examples of instruments commonly used are: [7]

- Graduate intern and placement programmes
- Direct support to technology adoption and adaptation projects
- Linkages between academic researchers and industrial companies
- Start-up services and seed financing

[7] See ARNOLD, Erik: Impact assessment for improving SME specific research schemes and measures to promote SME participation in the Framework Programme. EPEC Final Report, September 2006

## The international development context

The ICS was established for the benefit of developing countries as specified in the Institutional Agreement to promote technology transfer "with special reference to the transfer of technology from the industrialized to the developing countries as well as among the developing countries themselves"". Thus, to primarily be a development-oriented agency specialized in the promotion of science, research and technology transfer (SRT).

Many international organizations, donors, universities and private companies are equally active in the field of SRT promotion in developing countries and given its relatively limited size and budget the ICS is a small player, which, according to many interviewees, needs to find its "niche".

The interventions of the ICS are mostly related to fellowship programmes, publications & studies and short term training programmes. Even if the latter are carried out in developing countries, there are no instrument developed to ensure harmonization of the activities with those of other donors or agencies or alignment with the priorities set out in national policies, poverty reduction strategy papers and in the United Nations Development Assistance Frameworks (UNDAF).

The importance of mobility for technology transfer and development is well recognized and has led to a large number and variety of fellowship programmes. Basically, it stems from its fostering of the creation and diffusion of knowledge. Not only does mobility promote production, use and dissemination of codified knowledge (knowledge that is embodied in documents and institutions), it is also an important means of transmitting tacit knowledge (i.e. knowledge not available in written or other explicit form). Such knowledge is more efficiently transferred among individuals with a common social context and physical proximity.[8] There are many national and international institutions active in mobility related programmes, as specified below. The activities carried out by these national and international organizations focusing on the mobility of human resources is also a part of the ICS context.

One example of an institution promoting mobility, by offering fellowships on a global basis, is the British Council. Another example is the Fulbright Program, sponsored by the United States Government and designed to "increase mutual understanding between the people of the United States and the people of other countries." UNESCO fellowships provide opportunities for students to go abroad and pursue innovative training and advanced research in one or more of UNESCO's five major program areas: education, natural sciences, culture, social and human sciences, and/or communication and information. Moreover, the Robert S. McNamara Fellowship Programme, of the World Bank, supports development through innovative research. Most European countries have their own fellowship programmes to which students from developing countries can apply.

[8] See for example OECD (2008): The global competition for talent. Mobility of the highly skilled.

Furthermore, many UN agencies have fellowship programmes and there have been continuous efforts to harmonize the UN approach to fellowships[9]. In 2008 the ICS participated for the first time in a meeting of the Senior Fellowships Officers (SFO) of the UN System, presenting the results of its own fellowship programme to the participants[10].

## Conclusions on the ICS context

Operating within the Trieste system represents an important advantage for the ICS, since this offers a number of opportunities for cooperation and for tapping various scientific resources. This is especially important for a small institution like the ICS.

The organizational context of the ICS has a number of particular features that have posed a challenge to the development of the institution:

a) The international institutions with a claim for scientific excellence in particular ICTP and ICGEB have not had a similar degree of dependence or non-scientific management as the ICS.
b) The mandate of the ICS combines two fundamentally different tasks: research and technology transfer to industry whereas most other institutions specialize in only one of the two fields (either research or technology transfer).

Its mandate places, however, the ICS at the crossroads of science and industry. As the comparison with other institutions with similar mandates shows, many of the ICS activities would require active involvement of technology users (i.e. mostly private companies) in order to be effective.

The technology transfer function of the ICS requires harmonization with the many technology transfer oriented technical cooperation interventions that operate at a country level but as a scientific institution, the ICS is not well positioned within the context of international development because of its relative autonomy and a limited integration with UNIDO. While enhanced cooperation and alignment with UNIDO could reduce this weakness, it might at the same time pose a limitation to the scientific ambition of the ICS, since most other institutions with a research focus (e.g. ICGEB, ICTP) do enjoy more administrative and scientific autonomy than the ICS would have if tied even closer to UNIDO. In summary, there seems to be a trade-off between the scientific goals (research focus) and the development oriented goals (technology transfer to industry).

[9] 16th Meeting of Senior Fellowships Officers of the United Nations System and Host Country Agencies, Paris, 6-8 November 2006, Final Report
[10] Report on ICS-UNIDO Fellowship Programme, 17th Meeting of the SFO of the UN System, 2008

# 5
# Management, planning and coordination

## Management

As mentioned above, the ICS is governed by the **Institutional Agreement** between the Government of Italy and UNIDO, which entered into force in 1996 and outlines administrative and managerial arrangements. The Agreement also specifies the mandate and objectives of the ICS and its main functions. Various management functions were foreseen in the Agreement but it took many years until some areas were fully adhered to or implemented. There are also aspects of the Agreement that have not yet been implemented; such as the establishment of three distinct scientific institutes (see chapter 3) which were never established and rather turned into core areas of activities. The Institutional Agreement has been complemented by an Administrative Manual, see below, providing guidance on operational and administrative procedures.

The Institutional Agreement specifies that the ICS is established within the legal framework of UNIDO, as a scientific institution with autonomy. As part of UNIDO the ICS is subject to the same rules and regulations as other offices of UNIDO and enjoys the privileges and immunities of the Organization. There is, however, a certain paradox between being autonomous and a UNIDO project at the same time and it is not clear what kind of autonomy was actually envisaged.

The following functions were foreseen in the Institutional Agreement; the Rector, the Managing Director, the Steering Committee and the International Scientific Committee. The Rector and the International Scientific Committee were, however, not in place until 2007 and 2008 respectively.

The UNIDO **Director-General,** who has the full responsibility for the ICS, has delegated to the **Managing Director of the Programme Development and Technical Cooperation Division of UNIDO (MD/PTC)** the overall responsibility for the implementation of ICS's programmes and activities. The MD/PTC is the main allotment holder of the ICS project but has, in order to ensure flexibility, appointed an Alternative Main Allotment Holder, based at the ICS.

The day-to day- management of the ICS has been delegated to the **ICS Managing Director**. According to the Institutional Agreement, a Secretariat headed by a Managing Director was to carry out the assigned functions, under the overall guidance of a Steering Committee, consisting of two representatives of the Government of Italy, a representative from UNIDO and a representative from developing countries and under the authority of the Director-General of UNIDO.

The ICS Managing Director has, since the start, occupied a post at the level of Assistant Secretary General (ASG). There were 5 UNIDO ASG posts at the time the ICS was founded but the UNIDO HQ-based ASG level positions were abolished in 1993, which, in fact, presently makes the ICS Managing Director the second highest- ranking staff member of UNIDO. It was obviously envisaged that ICS would grow faster than what has been the case and that an ASG post was warranted for this reason (the Managing

Directors of ICTP and ICGEB were also assigned posts at the ASG level). The present incumbent previously held a high level position within the Italian Ministry of Foreign Affairs and has excellent qualifications, fully in line with ASG requirements. Nevertheless, the level seems unnecessarily high considering the actual size and level of activity of the ICS and its strategic positioning within UNIDO.

UNIDO has during the last few years strengthened the management of the ICS and a UNIDO staff member was, as mentioned earlier, "seconded" to the ICS in August 2006 to take up the position of Director of Administration and Programme Coordination. At the departure of the former Managing Director, this person became, as of July 2007, the Officer in Charge until June 2008. A new Administrative Officer was seconded from UNIDO in the beginning of 2009. These secondments have made ICS more versed with and in line with UNIDO rules and procedures. There are still, however, differences of opinions as to the optimal level of autonomy of and delegation of authority to the ICS. The system in place, with a rather high level of UNIDO HQ control has been designed with a view to remedy shortcomings identified in the past[11].

As mentioned earlier, ICS is subject to UNIDO's *Staff Regulations and Rules,* to its *Financial Regulations and Rules* as well as to its other administrative instructions. It is considered and administered as a UNIDO project but with somewhat different procedures as it was established as a subsidiary body of UNIDO (by a decision of the Industrial Development Board (IDB.8/Dec.11), endorsed by the General Conference (GC.4/Res.14)). Instead of a multi-year project document, implementation follows consecutive one year work programmes and budgets, in line with the annual contributions from the Italian Government. Under this set-up, the ICS has not been able to make financial commitments above a 12-month period and not beyond December. This has had as a consequence that ICS staff can only be awarded one year (L-series) contracts and that fellowships have to end in December and frequently need to be re-launched in the following year. ICS is now pursuing ways of extending contracts of professional staff beyond one year and this seems financially possible in view of the savings accumulated from previous budget-years. However, the administrative barriers to longer-term contracts have not been eliminated yet. During the November 2008 Steering Committee meeting it was agreed that budget "leftovers" should be accounted for as committed funds for the future budget and not as savings.

The **Administrative Manual** was developed in 2006 and 2007 and approved by UNIDO EB in March 2008 in order to strengthen internal management, promote increased transparency and foster alignment of ICS's administrative procedures to those of UNIDO. The Administrative Manual, among other things, paved the way for the designation of an Implementing Allotment Holder, based at ICS Trieste. The Manual provides a comprehensive management tool but some aspects have been found to be weak and it is presently being revised.

According to the ICS Administrative Manual, travel plans, for ICS staff, should be submitted on a 6-month basis and be approved by the MD/PTC. Procurement is authorized up to a maximum of euro 10,000. Moreover, the Administrative Manual provides guidance on the implementation of the Fellowship Programme, for instance in respect to the criteria for selection of counterpart institutions and fellows. It is, furthermore, specified that Counterpart Institutions should have strong operational linkages with both the local scientific and industrial sectors in order to guarantee a transfer to the final users of technology. Furthermore, Counterpart Institutions should be in synergy with UNIDO's technical cooperation programmes in the respective countries. It

[11] In 2004 an internal audit was carried out at the ICS. The audit report revealed a number of administrative shortcomings and recommended stricter control of ICS by UNIDO HQ.

also conveys that a standard evaluation should be carried out of each fellowship and specific procedures are provided for the implementation of ICS training programmes, workshops and expert group meetings.

Clearly, management functions, of the ICS, have been strengthened during the last few years. A "control framework" with various control functions has been put in place, sometimes so stringent that there are complaints of micromanagement. In fact, there is a lot of management of relatively limited resources and there are a quite a few layers of decision making. For example, the Plan of Action 2009-2011 was developed by the ICS management, in collaboration with the ICS Rector, endorsed by the International Scientific Committee, endorsed by the ICS Steering Committee and finally approved by the UNIDO Director General. While an inclusive and transparent process is certainly positive, the rather small overall volume of ICS activities calls for streamlined (but still inclusive and transparent) procedures.

Procedures are often felt to be too complicated and bureaucratic for a small set-up/administration. Still, ICS falls under UNIDO's responsibility and in order to ensure that internal procedures are followed a management and risk-management strategy has been put in place but these concerns should not take precedent over the need for efficient and results-oriented project delivery. As opposed to administrative management, UNIDO is not performing any quality control function over ICS's scientific outputs and does very little monitoring of technical activities/outputs.

A self-evaluation exercise was conducted in 2008 and generated useful information. The evaluation team also took note of the fact that a specific project had been developed for monitoring and for assessing the impact of ICS activities. In this respect, ICS is ahead of UNIDO.

**The International Scientific Committee (ISC),** headed by the ICS Rector, met for the first time in September 2008 and, at his meeting, endorsed the new strategy for the ICS including the four scientific core programmes. The ISC has 10 members, four of them come from developing countries and all members belong to the scientific research community. The ISC is planning to meet once every year. Its mandate is defined in the Institutional Agreement and mainly covering the provision of scientific guidelines for the programme and budget of the ICS.

The mandate of the **Rector** is to facilitate that the ICS will become the envisaged centre of excellence in research and training and addressing priorities of developing countries. As the ISC, the rector was not in place until 2007. The establishment of both functions represents an important step for the ICS towards becoming a more solid scientific institution. De-facto, the ICS Rector participates in the strategic planning and management of the ICS. The present incumbent of this, primarily honorary, position was the founder and former Director General of the ICGEB and has thus valid experience from directing an International Scientific Centre.

## Planning and coordination

Coordination with UNIDO's technical projects and programmes has been limited and ICS is not often mentioned in UNIDO's strategic planning frameworks. The main strategic and coordination functions are embedded with the ICS Steering Committee and the ICS management. The Steering Committee has four members, two representing the Italian Government, one UNIDO and one a developing country. There are also two Ex-officio members; the ICS Managing Director and the Rector. The Steering Committee meets yearly.

Specific *Steering Committee Rules of Procedure* were adopted by the Steering Committee at its first session in May 1996. The Steering Committee has been given various responsibilities, such as the review and adoption of the programme and budget. As concerns existing strategic planning instruments such as the Plan of Action 2009-2011 and the 2009 Work Programme, these were prepared by ICS management and endorsed by the Steering Committee for final approval by UNIDO's Director General. All the presently used planning documents are results of joint efforts of UNIDO and ICS management and of an informal Expert Group Meeting in 2007.

A subsequent "ICS Plan of Action for the Future" incorporating recommendations from the Expert Group Meeting was developed by the ICS Rector and the Director of Administration and Programme Coordinator. The ICS Plan of Action for the Future was endorsed by the ICS Steering Committee and the incoming Managing Director, in 2007, and was the basis for the first meeting of the International Scientific Committee. The suggestions and recommendations of the International Scientific Committee were considered in the latest strategy document; the ICS Plan of Action for the period 2009-2011. This Plan of Action has been complemented by the 2009 Work Programme, also endorsed by the Steering Committee and approved by the Director General. The recent strategic and planning documents focus on the four core scientific programme areas, outlined above and on a project on e-learning while activities in other disciplinary fields are being discontinued.

**The ICS Work Programme 2009** is based on the draft Plan Action Plan for the Future and aligned to 2009-2011 Plan of Action and is a valid attempt to develop an annual work programme anchored in a strategic perspective. Moreover, there has been adoption of results based principles. The evaluation team found however, that the results orientation of ICS's strategic and planning documents, including the ICS Work Programme 2009, could be strengthened by avoiding primarily activity-based planning and putting a stronger emphasis on the outcome and impact dimensions of ICS interventions.

Also, more attention could be given to the formulation of SMART objectives at various levels and to developing indicators for the objectives. As an example; build awareness, create a network, introduce new fields and strengthen centres are rather activities, than as presently stated, outputs. It needs to be kept in mind that all these activities are done for a certain purpose and outputs should rather be formulated in terms of the "product" we are aiming for (thus the end rather than the means) and, for instance, in relation to the former examples, rather specify what kind of awareness should be promoted, for whom and for what purpose, the characteristics of the envisaged network or "that centres will have capacities to undertake designated specific functions".

There is a clear need for Results Based Management (RBM) and for RBM training of ICS staff, as under present circumstances effective and efficient results-oriented implementation and monitoring will be difficult. Moreover, the Work Programme is too general to be a useful planning and monitoring tool; activities are often very vague; "seminar (to be defined)", "selection of experts", "training of fellows", "drafting of reports" and the same can be said for outputs; "research on design and development of new anti TB compounds performed, results published and fellows trained".

ICS should have due credit for having developed an ambitious Strategy and Work Programme but there are many potential barriers and risks. Among the risks identified by persons interviewed by the evaluation team belong; inability to get the right fellows and access suitable principal investigators, the non-use of developed competencies or research, inability to network with African institutions and centres of excellence, inability to liaise with the industrial sector or involving the R&D departments in the ICS research programmes, inability to go beyond research to technology transfer, the unavailability of

budgetary resources at the scale needed to reach results, ICS not being able to measure the impact of the research activities and insufficient cooperation with UNIDO Technical Cooperation (TC) Branches.

During the last few years various efforts have been made to coordinate ICS activities with UNIDO HQ projects and programmes. This led to stronger cooperation in some areas (e.g. Cleaner Production, Persistant Organic Pollutants). However, these areas, where UNIDO – ICS ties were the strongest, have been discontinued and are not part of the current ICS portfolio. With the exception of the SC, no explicit mechanism is in place to ensure regular coordination with UNIDO's technical cooperation programmes and global forum activities.

## Conclusions on management, planning and coordination

The ICS management has improved during the past few years and important steps have been taken to establish all functions envisaged in the Institutional Agreement. A number of hurdles remain, however, that can become important barriers to the achievement of the ambitious goals of ICS. In relation to the management and planning structures there is a clear weaknesses in terms of results orientation and the alignment of UNIDO's and ICS's programmes remain weak.

# 6
# Design

From a substantive and functional point of view, the ICS needs to be analyzed from two perspectives. On the one hand, it is a UNIDO project and on the other it is an international institution in its own right. Thus, when analyzing the design of the ICS, both aspects will be taken into account.

## The ICS as an international institution

The original set-up of the ICS was in line with the proposal for its establishment made by Professor Abdus Salam and governed by the results of a number of preparatory activities carried out in 1988 and 1989. The original proposal put a strong emphasis on the need for more science based technologies and foresaw, as mentioned above, the establishment of three scientific institutes within the ICS.

While the three institutes were never established, the designated broad research areas provided ICS with its scientific focus. It is not known to what extent these areas reflected the actual demand for scientific capacity and technology development of developing countries or what criteria were applied for their selection.

However, prior to the institutional establishment of the ICS, consultations with scientists from Italy and the developing world were carried out[12]. A high level advisory panel comprising three Noble Laureates[13] subsequently confirmed the validity of the proposal to set up the ICS.

The objectives of the ICS, as reflected in the Institutional Agreement, were defined as:

- to further, for the benefit of developing countries, the utilization of applied science for peaceful aims, and the development of science-based technologies;
- to promote and stimulate high-level research with a direct involvement of developing countries' scientists, and
- to provide conditions and structures for the professional promotion of scientists and technicians of developing countries.

An additional overall objective was to: "develop and strengthen the scientific and technological capabilities of developing countries in the creation and application of scientific knowledge". The main instruments of the ICS were described as: training, research, workshops & scientific meetings, fellowships, advisory services, cooperation with industry, cooperation with relevant national institutions and technology transfer.

The Agreement does not establish priorities with regard to the different objectives and functions of the ICS and does not explain how the functions are supposed to contribute to

[12] Long-term arragements for the establishment of the ICS, Report by the Director General, June 1991
[13] Idem

the achievement of objectives. By foreseeing the establishment of three dedicated research institutes, the implicit priority of the Agreement appears to have been on the research function of the ICS.

It was recognized that the ICS needed to be an institution of a long-term nature in order to a) attract high level scientist and provide them with a stable environment and b) to allow for the time required to set up and maintain effective research capacities[14].

The Agreement, however, does not define UNIDO's role in supporting the ICS from a substantive point of view (e.g. quality control of projects, technical backstopping for parts of the ICS activities, liking ICS with industry, etc.).

## The ICS as a UNIDO project

While the purpose of the ICS as an institution was clearly defined from the beginning, the purpose of the UNIDO support to the ICS were made explicit only with regard to providing the ICS with a legal foundation (that of UNIDO) and the necessary administrative systems (contracting of staff and consultants, procurement of equipment, financial reporting, etc.).

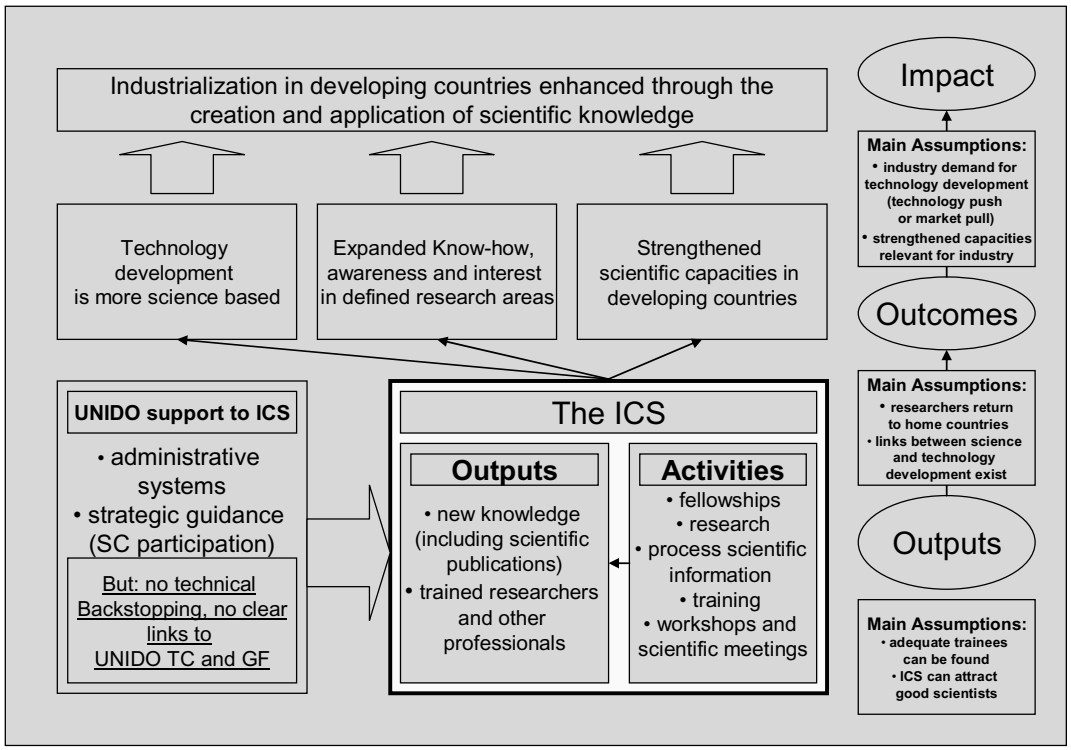
With regard to the substantive or technical role of the ICS or of UNIDO in relation to the ICS, no project document was formulated to provide guidance on how the institutional objectives were to be achieved, the envisaged UNIDO technical support or the envisaged ICS support to developing countries. Only in recent years, starting with an in-depth analysis of the ICS activities and its cooperation with UNIDO, the potential of a stronger technical relationship between ICS and UNIDO has been discussed[15] and some concrete activities have been planned and implemented to strengthen the technical relationship (stronger involvement of UNIDO field offices in the identification of ICS partners and consultations with UNIDO HQ technical branches). Furthermore, the above mentioned Administrative Manual introduced a set of criteria to ensure appropriate selection of fellows and counterpart institutions (e.g. links with the industrial sector, counterpart contributions, etc.). This represents a potential step towards a better link between ICS activities and the industrial development objectives of UNIDO.

There has been no project document approved for the ICS, nor any intervention logic developed. Combining the information available on ICS's global objectives, immediate objectives, intended functions and the activities outlined in work programmes, an overall intervention logic was reconstructed by the evaluation team and is provided as Diagram 2 below. The intervention logic is based on the logical framework concept and makes the perceived logical linkages between activities, outputs, outcomes and impact visible. More importantly, the intervention logic introduces a number of underlying assumptions, which are seen as prerequisites for the ICS to achieve its objectives. From Diagram 2 we find that there is a clear intervention logic that can be made explicit for the ICS.

However, given the relatively small size of the ICS in budgetary and staff terms, the objectives and outcomes of the ICS as described in Diagram 2 appear to be too wide and comprehensive. For example, no specific activities and outputs are foreseen or are possible within the available budgetary resources that would allow for an effective contribution to the outcome of more science based technologies.

[14] Idem
[15] ICS, Action plan for the future, 2008

Diagram 2:
Summarized intervention logic for the ICS (and UNIDO support to it)




Another finding is that the work programmes and other ICS documents do not clearly establish a clear priority for either the development of new scientific knowledge (pure and applied sciences) or the roles of capacity building and of processing existing scientific information and acting as an intermediary and training institution.

## Conclusions on design

The overall objectives of the ICS as a promoter of science-based technologies for developing countries have been clearly defined in the preparatory consultations prior to the institutional establishment. The Agreement, later on, provided a framework for the operations of the ICS. There is, however, no clear description in the available documents (Agreement, work programmes) as to how the different functions of the ICS are supposed to contribute to the different objectives.

From the different ICS related documents it is not possible to see what the priority objectives and functions of the ICS are. Is it the building of scientific capacity through research and fellowships or is it the more science based technology through industry cooperation and technology transfer? Given the limited ICS resources it sees too ambitious to aim at all objectives at the same time and to aim at excellence in all functional areas (training, research, technology transfer, etc).

The role of UNIDO in supporting the ICS has not been described from a substantive point of view. The Agreement does not refer to it and the document where this would normally be explained – a project document – does not exist.

# 7
# Relevance

The mandate and areas of operation of the ICS are specified in the Institutional Agreement and are in line with or complement those of other international scientific institutions of the Trieste System and relating to the promotion of science and technology in the developing world. ICS core areas and sub programmes were, however, identified over twenty years ago and the evaluation has attempted to assess to what extent the ICS mandate and core programme areas are still relevant and to what extent ICS has adapted in view of evolving needs and priorities.

During the last few years there have been many worthwhile initiatives to update the ICS strategic framework in view of changes in the external environment and evolving needs of partner countries. Another aspiration has been to re-position ICS within the context of the existing international scientific community in Trieste and ensure proper linkages to UNIDO's programme. For the latter purpose, consultation meetings have been organized between ICS and UNIDO PTC staff. The resulted new strategic orientation entails a strengthening of the research component and the continuation of capacity building activities (workshops, training programmes and a fellowship programme). The strategic reflection process resulted in the four, somewhat different, core programmes that have already been mentioned. Their relevance is discussed in the following paragraphs;

According to the ICS management and to strategic documents **the rational drug design** programme will through the combination of structural knowledge, informatics, chemical synthesis and pharmacology promote the solution of some of the most pressing health problems and work on some of the orphan diseases (malaria, mycobacterium tuberculosis, HIV/AIDS and Dengue fever) of the developing world. There were also possible synergies and areas of collaboration with the ICGEB.

Rational drug design is thus considered to be of particular relevance to developing countries and for the development of the pharmaceutical sector in these countries, which are in need of technical capacities. Rational drug design cannot, however, be easily linked to UNIDO's ongoing programme and, moreover the UNIDO Chemical Branch and Pharmaceutical Programme have ceased to exist[16].

Furthermore, drug design is a highly research intensive area where many well-resourced public and private companies are active and where there are large and a growing number of funders; the Global Fund to fight AIDS, TB and Malaria, the Malaria Initiative, the World Bank's Booster Programme, the $100 million Malaria Capital Campaign and new drugs are appearing and becoming widely available. Only, the University of California, Berkley, is undertaking a malaria research project with a $ 42 million funding from the Gates Foundation. Moreover, scientists recently began final-stage clinical trials of what could become the world's first malaria vaccine. In light of the above and in view of the limited available resources, the intention of the ICS to become a centre of scientific excellence in

[16] Currently UNIDO implements only one project on the promotion of generic drugs production in developing countries.

this area is very ambitious and maybe unrealistic. Also to target four areas for new potential drugs does not seem feasible at this stage.

The programme devoted to **next generation Biofuels** intends to promote environment friendly energy through biologically produced ethanol, diesel fuel or hydrogen, without competing with food production, through the exploitation of low-grade bio-sources (marginal land shrubs, forest undergrowth, sawdust, algae and infesting agents like water hyacinth). According to the ICS Work Programme, the ICS will focus on advanced chemical technologies for exploitation of bio-feedstock.

UNIDO has recently developed a draft strategy for Biofuels, with inputs from the ICS, but the ICS does not really figure in this strategy and there seem to be somewhat divergent views as to what ICS should actually do. ICS sees itself more as a think tank and research institution, performing actual research in relation to catalytic processes for Biofuels production whereas technical staff at UNIDO would like to see ICS become more of a technology and information broker and put additional focus on the industrial conversion aspects and work on promoting and adapting relevant technologies in these areas. At the present time, there is limited synergy between the ICS Work Programme and the UNIDO draft Biofuels Strategy. The focus on second generation Biofuels is, however, considered as relevant by UNIDO and ICS staff members but there is an absence of common objectives or a common vision. Moreover, the issue of possible industrial use or linkages seems to be neglected. UNIDO Headquarters staff mentioned industrial waste as a possible area of collaboration. There is, however a potential linkage to the Cleaner Production (CP) Programme and its attention to efficient production and minimum waste in the area of bio-based by-products.

There is an uncontested need for competitive conversion technologies.[17] UNIDO/ICS can probably play a role in the transfer of relevant Biofuels technologies but there is also a need for associated capacity building and the assessment of existing technologies, the provision of guidance on industrial applications (i.e. productive use of Biofuels) and associated information dissemination and training.

**Geothermy** is an underexploited and clean energy source with huge untapped reserves in developing countries and especially in Africa and with the need of novel methods for prospecting, site evaluation and extraction. ICS will primarily work towards the optimization of the procedures for the selection, identification and localization of geothermal anomalies that are showing potential to become exploitable geothermal fields, on technologies for reservoir characterization and initiate a study of innovative technologies for energy extraction.

Geothermy has uncontested relevance from energy supply and access points of view but the relevance from the perspective of promoting energy for industrial use is less obvious. There are, in addition, no immediate linkages to UNIDO's programmes and projects carried out by the Environmental Management Branch or the Energy Branch nor is there geothermal expertise at the UNIDO headquarters.

Geothermal energy was an area where ICS was active in the past but not in the field of pure research. Another environmental-oriented area in which ICS had been involved in the past; coastal zone management has been abandoned. The medicinal plants programme was also dropped, while renewable (Biofuels) energy has been added.

**Nanotechnology** is an area presently getting a great deal of attention and which has a wide spectrum of applications; chemical industry and engineering, electronics, ICT,

[17] See UN-Energy paper on Sustainable Bioenergy: A Framework for Decision Makers (UN-Energy 2007)

biotechnology for medicine, agriculture and energy savings. The ICS Work Programme includes a study of the most appropriate areas of application and development of Nanotechnologies for developing countries and countries in economic transition. The targeted areas include the development of Nanotechnology-based diagnostics and of drug-delivery systems based on derivatized Nanocarbon particles and of advanced electron microscopy for Nanoscience. There could be solutions for drug delivery systems and there are thus linkages with the drug design area of ICS. Cross-fertilization with the ICS e-learning project is being envisaged by the ICS management.

It is however, less evident how this area fits into UNIDO's strategy or thematic priorities and how planned activities can contribute to UNIDO's objectives as there are no direct linkages and limited immediate relevance of the activities promoted to the industrial sector. There are, however, several ongoing and planned UNIDO initiatives in the area of Nanotechnology and mainly through other International Technology centres. At the same time there is no UNIDO policy or strategy on the promotion of Nanotechnology and in particular related to industrial applications.

**E-learning & Networking**

This sub-programme is relevant as it will strengthen ICS's position as a technology broker. In addition, the impact of ICS's outputs is expected to increase through a wider dissemination. This is a sub-programme that in terms of capacity building has an internal focus but which can be expected to benefit UNIDO at large.

## General comment on relevance

The justifications for the 4 new areas, as expressed in the Action Plan and the 2009 Work Programme were; solving health problems, repositioning the ICS, interaction with the Trieste system, going back to the original ICS mandate, to be in line with the Agreement, strengthening the ISC and making it a centre of excellence and making it similar to the ICGEB. These reasons all have their own merits but are not always justified from an industrial development, energy or environmental angle or from a developmental or a UNIDO perspective. Thus, the arguments for selecting the designated 4 scientific programme areas are somewhat weak and not aligned to wider stakeholder needs and priorities.

Generally, the evaluation team finds that it is, difficult to pronounce itself as to the relevance of the respective research programme, as the objectives provided for the areas are neither Specific, Measurable, Attributable, Realistic or Time-bound and it is not clear what the ICS will actually do or contribute to. We will take the Rational Drug Design and Development Programme as an illustration, for which the 2009 Work Programme provides the following Long-term objectives.

- Improvement of R&D skills and build capacity in selected developing countries in the field of anti-malaria design and development in order to enhance the competitiveness of the economies of the developing countries (DCs) on the global market
- Strengthen international cooperation in the field between local and European institutions as well as among specialized institutions in DCs
- New development (technologies and products) and scale-up of new processes in DCs.

Specified outputs are equally provided (the evaluation team's comments are in brackets);

- 25 experts trained (*no specification on what)*
- Laboratory facilities designed and research plan elaborated (*rather activities than outputs)*
- Research on Design and Synthesis of Anti-malarial compound performed, fellows trained, results published (*very vague, rather activities, not SMART)*
- ICS Network on Anti-malarial Drug Design and Development established (*OK)*

## Relevance to developing countries

For almost no ICS project, presented in the 2009 Work Programme, is there an indication on how the industrial sector or institutions in developing countries are expected to benefit, how the development of new technologies and research outputs will be promoted or how processes will actually be implemented and used in developing countries. Neither are there indications on to what extent the selected projects/activities are in line with priorities of developing countries,

The ICS is, nevertheless, considered as relevant to developing country partners in that it enables access to know-how and technology and contributes to the development of research capacities. All of the ICS training programmes reviewed by the evaluation team had, primarily, participants from developing countries and they have in training programme evaluations conveyed a high relevance of the training provided.

Fellows normally come from developing countries' national research institutions and African countries have been given priority in the allocation of fellowships. In 2008, 32 per cent of the fellows originated from Africa. There is indication that the ICS has become more development oriented during the last few years and, in general, the geographical distribution of fellows and participants in ICS organized training events, is an indication of this.

When fellows are being placed the ongoing research programme of the host institution, usually a university, seems to be the starting point but also the needs of the sending institution are being considered. Still, as was the case for participants of ICS training programmes, most of the ICS fellows rate the relevance for their home country, of the research undertaken, as high.

Very few research institutes, in the developed world, have a mandate to train people from developing countries (although most Universities accept foreign students) and the ICS is in this perspective a unique and pertinent institution.

The evaluation team also noted that the new ICS strategy gives increased attention to longer-term relationships with its affiliate centres in developing countries and that this could entail an increased capacity building focus, beyond the fellowship programme.

## Relevance to industries in developing countries

In the past, the ICS has played more the role of a broker of scientific information than that of a research institute. ICS publications, training events and fellowships have often provided a solid overview of state-of-the-art know how. In the new ICS strategy there is a change towards more basic scientific research. This change in strategy and a decreasing attention to applied research bears the risk of reduced relevance of the ICS to industries in developing countries.

Presently, ICS fellows come mostly form scientific and government institutions and not from research and development departments of Industry. This indicates that ICS activities can be of relevance to industry only indirectly, depending on the linkages that exist between the client institutions and industry. Some stakeholders interviewed by the evaluation team were of the opinion that a more direct ICS/industry relationship was premature, others conveyed that the industrial sector in developing countries need new and applied scientific knowledge and technologies and that this should be given priority. The absence of a representative of the industrial sector on the ICS International Scientific Committee is noteworthy.

Whether or not the ICS is relevant to industry in developing countries cannot be easily be answered but merits more attention and can, ultimately, only be answered though an assessment of to what extent the research promoted and developed by the ICS is being used by industry and has been beneficial for the development of industrial sectors or sub-sectors. It should also be kept in mind that different instruments of know-how- and technology transfer are relevant to different clients and the absorptive capacities of industry can differ widely, e.g. between sectors and between those located in a least developing country and in a middle-income country.

## Relevance to UNIDO

Article 2 of the UNIDO Constitution states that “UNIDO shall promote, encourage and assist in the development, selection and adaptation, transfer and use of industrial technology, with due regard for the socio-economic conditions and the specific requirements of the industry concerned, with special reference to the transfer of technology from the industrialized to the developing countries as well as among the developing countries themselves”. An international centre for science and technology with the objective to develop and strengthen the scientific and technological capabilities of developing countries in the creation and application of scientific knowledge thus clearly fits the UNIDO mandate.

The analysis of the relevance of the ICS to UNIDO is also done in the light of UNIDO’s strategic and thematic priorities, the organizational development objectives and outcomes, the “Delivering as One UNIDO” agenda and through assessing potentials for synergies and for linking up with UNIDO’s technical cooperation projects and programmes.

Two of the newly designated areas; Biofuels and geothermal energy are aligned to UNIDO’s mandates of environmental management and promotion of sustainable energy. For others there is less alignment and the present focus on pure scientific research has less relevance to a technical assistance agency, such as UNIDO, than would be the case for applied science or technology transfer.

Moreover, UNIDO is not the same organization today as it was when the ICS was established. At that time UNIDO had a Chemical Branch and a Pharmaceutical Programme, a Branch dealing with metallurgical and extractive industry and there were potentials for synergies in these areas. Some programmes/areas might thus have been more relevant in the earlier days of UNIDO. In addition, the evaluation team found that ICS staff members were not always aware of UNIDO’s present priority areas and programmes.

As regards the largest ICS research area - rational drug design - there is, as mentioned above, limited potential for synergies with UNIDO as this is not a UNIDO core area and there is no in-house competence. It is true that UNIDO is presently implementing a global

project with the objective to promote local production of generic drugs in least developed countries. However, no role, apart from consultation with the ICS at the design phase, was envisaged for the ICS in this project. As to other linkages with UNIDO technical branches, a staff member of the Private Sector Development Branch attended the ICS Workshop on "Advanced Design and Development of Potential Drugs against Malaria", held in March 2009 in order to identify areas of complementarities but nothing materialized.

UNIDO's present Medium-term Programme Framework (MTPF) 2010-2013 puts emphasis on the access to technical know-how for pro-poor and inclusive growth and mentions the limited success of many countries in moving towards a knowledge-based economy, due to insufficient endowment of skills and cutting-edge technologies. These are areas where the ICS could provide value added to UNIDO. At the same time, from this and other UNIDO strategic and planning documents it is not obvious how the ICS is expected to contribute or how the ICS strategic plan complements UNIDO's. The MTPF mentions UNIDO's intention to contribute to the promotion, transfer, application and diffusion of new enabling technologies and innovations in developing countries but does not specify any role for any of the UNIDO managed International Technology Centres (ITCs). Furthermore, clean energy technologies are specifically targeted and many ITCs are active in this area but also, in this case, there is no information as to their potential contribution.

In addition, in the Programme and Budgets 2010-2011, under Programme Component C.3: Investment and Technology Promotion, it is stated "that UNIDO will provide capacity-building services in such areas as the transfer and diffusion of new technologies, the management of technological change and technology needs assessment and negotiations. Particular emphasis will be given where appropriate to the enhanced application of new and emerging technologies that have wide applications or impacts for the achievement of a low-carbon economy. This will be supplemented by the provision of methodologies and tools for the creation and strengthening of national innovation systems." Again no role or responsibility of any International Technology Centre is foreseen in the document but would seem to be possible as, for instance, the ICS has relevant competences and.

The General Conference Resolution (GC.7/Res.12) of 1997 recognized "the pertinence of the activities of the Centre (ICS) to the mandate of UNIDO in the field of industrial technology and the interest to strengthen the research component of the ICS work programme" but also mentioned the possibility of transferring the ICS to UNESCO and ending the Institutional Agreement, by mutual consent. In fact, the latter was considered an option a few years ago but since there has been agreement among the two parties; the Government of Italy and UNIDO that the present arrangement is appropriate.

The evaluation confirms that the ICS can be considered as relevant to UNIDO's thematic priorities of industrial development, energy and environment but the newly identified research areas can be seen as a step away from UNIDO's agenda rather than alignment, whereas areas where there were established collaboration and synergies such as **Cleaner Production** have been dropped. Over a relatively long period (about 8 years) the Environment Area (ICS) provided support to the Cleaner Production Unit to train experts from selected National Cleaner Production Centres (NCPCs) in process simulation for modelling and in optimising industrial processes, in order to reduce the environmental impact. There was also work on degradable plastics in the past and this work was found to be relevant to the large UNIDO network of Cleaner Production (CP) Centres. Thus, in the past, the ICS organized valuable and relevant training for NCPCs and contributed to building capacities of the CP Network.

In particular, important results were achieved in relation to the development of computer simulation tools to optimize reaction training provided to NCPC staff and affiliated consultants. The training in the Latin American region on process simulation and optimization was considered to be of high relevance and usefulness. There was a good level of coordination with staff members of the CP unit at UNIDO HQ and discussions had been initiated tot develop more targeted CP-related training and for the ICS to provide capacity development and research-oriented support to the NCPCs. Also, the process simulation tool could have been developed further, to build on activities initiated in the area of purification and recycling of heavy metals and there were discussions about organizing a joint training programme on chemicals used in textile production.

For the training programmes, in process simulation and optimization, organized for the CP Unit to CP partners in Mexico and Cuba, there was a high degree of client (UNIDO) orientation and this resulted in highly relevant and successful training programmes. There was also training in Latin America and organized jointly with the CP Unit on “inventory of releases from companies”. A process simulation tool had also been developed for energy efficiency and was highly appreciated.

In particular the broker (on CP-related technologies) function of the ICS was valued and the information being made available on relevant research undertaken by various research institutions appreciated. Many CP centres are active in the area of chemicals management and this is a field where collaboration could, according to UNIDO staff members, have been expanded. Other potential areas were energy and raw materials efficiency, use of wastages and reutilization of by-products with chemical content. It could still be useful for the ICS to look into possibilities to link up with the new CP Programme and identify areas where it could contribute to the achievement of the objectives of this programme. In the past there had also been valuable cooperation with the POPs programme but also this area has been dropped. Assessment of technologies was carried out but this was never a big ICS area.

As regards new programme areas, it seems relevant to concentrate on the more appropriate second generation Biofuels and this is in line with UNIDO’s agenda on the promotion of green technologies and the next generation Biofuels’ programme has a clear link to the energy and environment programmes of UNIDO. The ICS could, in selected areas, function as a bridge between researchers and technology users in the Third World and promote the transfer of appropriate technology to partner countries. There is an identified need for surveys and analyses and the sharing of experiences and best practices and the identification and promotion of state of the art technologies. ICS could equally be involved in capacity building and applied research but needs to orient its activities wisely in view of the limited funding at its disposal. In comparison the British Petroleum has allocated British pounds 500 million for research in relation to next generation Biofuels.

An area with emerging cooperation with UNIDO is geothermal energy, where there are joint events implemented and planned but still limited UNIDO “in house” competence and no UNIDO Technical Cooperation (TC) projects. So far, the ICS is not working on aspects of industrial application. Moreover, advanced methods in geothermal reservoir engineering does seem a bit distant from UNIDO’s mandate. In the Work Programme it is indicated that there are no links with UNIDO HQs Programme/Branch.

The evaluation team found that generally, there has not been given much attention to how ICS projects will collaborate with UNIDO’s technical branches and, moreover, UNIDO planning documents, such as the MTPF, are vague on how UNIDO’s technical branches will collaborate with International Technology Centres, including the ICS. Limited attention is given to industrial application or use in the description of the planned research projects. Generally, ICS thematic areas are often quite different from UNIDO’s

which reduces the relevance of ICS to UNIDO as well as opportunities for synergies and for “Delivering as One UNIDO”.

In terms of principal ICS functions, the broker function can be seen as more relevant to UNIDO than the research function and many UNIDO staff members stress the need for information on relevant research coming out from the world wide research community and on new and existing technologies.

There is, nevertheless, a potential for the ICS to become more of a contributor to the achievement of UNIDO’s strategic objectives and enrich its global forum function, in areas such as Biofuels or Nanotechnology, work on industrial applications and provide inputs to technical assistance programmes, concerned with technological development and transfer of technology, not the least green technology and to liaise with UNIDO’s larger network of technology promotion. A strategy on technology transfer is presently missing within UNIDO and this is probably one reason for the limited cooperation with different ITCs. Moreover, the E-learning project could benefit the entire UNIDO system and there are potential linkages to COMFAR, standards and quality and technology foresight interventions. Many UNIDO staff members consulted would like to see ICS focus more on inventory and analysis of technologies and processes. The argument being that here is a lot of technology development but few neutral actors around to assess and disseminate information on the developments.

## Relevance to Italy

The ICS is considered to be in line with the development cooperation objective of the Italian Government and its focus on economic growth. It is also in line with the objective of the Government of Italy to create a cluster of scientific institutions in Trieste for the benefit of developing countries. In this context, the ICS is an instrument to promote linkages between Italy and developing countries. It also increases the visibility of Italy on the international scientific, technological and development arenas. There is alignment of the ICS research agenda with the research agenda of universities and research institutions in the Trieste area and elsewhere in Italy. The ICS benefits from these institutions and their resources and know-how generated and these institutions, to a certain extent, benefit from the ICS as, at times, their research budgets are complemented by ICS funds.

Many ICS programmes and research projects do have linkages to ongoing research of the University of Trieste and the ICS can definitely benefit from the presence of renowned scientists in Trieste, but this reliance and at times it seems alignment with ongoing Italian research projects gives the research programme somewhat of a supply rather than demand orientation.

The long-term and continuous, almost institutionalized, funding of the Government, can be seen as a sign of relevance and commitment. The continuous relevance to Italy also seems to be manifested by the fact that the ICS has not, contrary to many other publicly supported institutions in Italy, been affected by budget cuts. On the other hand, the relatively small budget amount can be an indication of limited relevance. Moreover, the constant budget contribution, in absolute terms, has eroded the real budget value over the years.

## Conclusions on relevance

The present ICS Work Programme was developed with limited involvement of developing countries, the industrial sector or UNIDO. The focus is more on undertaking general research and training young researchers than on promoting research for industrial application. The established cooperation with developing country institutions seems worthwhile but it is often not clear what the cooperation will entail, beyond sending a research fellow to an Italian institution or to ICS Trieste or in what way the research undertaken will contribute to capacity building or the objectives of the partner institutions or how results will be used by industry.

The relevance of ICS to industry depends on the existing linkages between S&T institutions and the industrial sector. The ICS, so far, has not addressed the issue of strengthening these linkages and the direct relevance of ICS to industry is currently limited.

The relevance of ICS for S&T institutions in developing countries is generally high, but it is not obvious that the new core areas will be relevant to a wide range of countries and especially to low income countries. The relevance of ICS to UNIDO is currently rather low. The new strategic orientation entails a move away from a broker role to that of a research institution and will probably weaken opportunities for complementarities with UNIDO at large as many ICS research areas are not aligned to UNIDO's strategic priorities. In the view of rapid technology development and the fact that few neutral actors are around to assess and disseminate information the ICS broker role remains relevant.

Summarizing the relevance of the ICS for its main stakeholders and target groups, a number of strengths and weaknesses can be identified. Table 2 shows weak areas in red, mixed areas in yellow and strong areas in green.

**Table 2: Relevance of the ICS***

| | | Developing country industry | Developing country S&T institutions | Italy | UNIDO |
|---|---|---|---|---|---|
| Core areas | Biofuels | | | | |
| | Nanotechnology | **Both areas might be of interest to middle income countries only** | **Both areas might be of interest to middle income countries only** | | **UNIDO activities on Nano-technology scattered** |
| | Drugs Design | | | | **Currently almost no UNIDO activity in this area, but there might be a potential** |
| | Geothermy | **No relation to industrial use** | **Limited potential as geothermy research potential only in selected countries** | | **No relation to industrial use** |
| Core | Broker of | | | | |

| | | | | | |
|---|---|---|---|---|---|
| function s | Scientific know how | | | | |
| | Generator of new scientific know how | **Very few companies in developing countries require support in research (either** | | **ICS to small to be of relevance for Italian S&T output** | **UNIDO does use/need new scientific know how only in a few areas** |
| Core services | Research | **The present way of ICS operation does not establish a direct link with industry** | | **Not obvious why Italy should have additional research capacities in ICS and not rather support own universitie s** | **Research groups in ICS only relevant if in areas of UNIDO interest (e.g. POPs, CP, MP)** |
| | Fellowships | **Currently no fellows from industry or with link to industry** | | | **More involvemen t of industry in fellowships needed** |
| | Trainings | **Currently very few participants from industry** | | | **More involvemen t of industry and UNIDO partners in trainings needed** |
| | Publications & e-learning | | | | |

| * Colours indicate degree of relevance | No relevance problems identified | some relevance issues to be addressed | Serious relevance problems |
|---|---|---|---|

# 8
# Effectiveness

The following analysis is linked to the re-constructed intervention logic as described in Diagram 2 above. The evaluation team also bases its findings on the ICS Annual Report for 2007, a report on the ICS fellowships programme implemented in 2008, a set of self-evaluations for the main scientific areas and several documents on individual fellowships and training programmes. These documents plus information collected during interviews and via the ICS web site enabled the following assessment of ICS effectiveness, or the achievement of its objectives, focusing on the recent past.

## Activities to outputs

The core activities of the ICS have been identification, selection and administration of fellowships and implementation of research, short term training programmes, workshops and scientific and expert group meetings. All of these activities contribute to mainly two outputs: a) new or existing knowledge (including scientific publications) and b) trained researchers and other professionals.

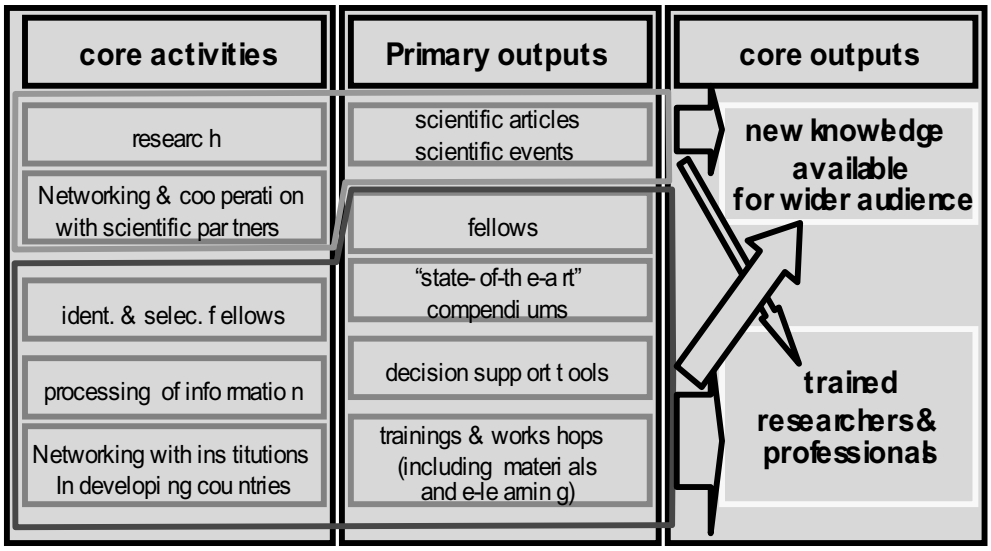
Overall, ICS's work can be grouped in two distinct but interrelated areas: activities related to ICS' own scientific research agenda and activities related to processing and transferring scientific research results produced by others. This distinction is made in light of the ICS' new strategic focus on in-house research, while in the past the ICS focus was more on the processing and transfer of existing knowledge. Diagram 3 (next page) provides an overview of the core activities and their relation to ICS products and core outputs.

### Fellowships

Fellowships are supposed to contribute to the core outputs as well as to all three outcomes (see Diagram 2) of the ICS.

The implementation of a fellowship programme has always been a major activity of the ICS. In 2007, 18 fellowships were awarded to participants from Africa (28%), Asia/Pacific (33%), Europe (17%) and the Americas (17%) and in 2008, the ICS awarded 43 fellowships to individuals from Asia/Pacific (40%), Africa (32%), Europe (9%) and the Americas (19%). 7 of them (16%) came from least developed countries (LDCs) and 17 (40%) were female. 51% of the 2008 fellows were trained at the ICS, 44% by universities in Italy and 5% by universities in Germany. 7 fellows (16%) possessed a PhD and 19 (45%) a Masters degree. Fellows came almost exclusively from Universities and Government institutions.

Diagram 3:
ICS - activities, products and outputs




ICS research is interlinked with the fellowship programme and a large part of the research is actually done by fellows. Unfortunately the reporting, on fellowships does not include information on the results achieved by the fellowship programme in terms of scientific output, uptake by industry or level of qualification reached by fellows (e.g. in how far the fellowship helped the fellow to complete a PhD, etc.). However, in the area of chemistry, out of 7 peer reviewed publications listed in 2009 (partly yet in press) 6 were co-authored by ICS fellows. Comparing information from the publication lists and feedback from interviews, it appears that mainly the PhD level fellows and principally those working in the chemistry area, were responsible for producing scientific outputs of reasonable quality. Survey results confirm this: about 50% of the fellows produced some kind of research paper but less than 10% produced a published scientific article.

Overall, there has been a rather moderate share of PhD level fellows (16% in 2008, 26% among respondents of the survey) and this reduces the potential of the fellowship programme to contribute to high level scientific outputs. Also it was mentioned, during interviews, that it is often difficult to get sufficiently qualified fellows from least developed countries, which might represent a bottle-neck for the new ICS strategy, with a focus on excellent in-house research. The fact that the ICTP focuses its entire programme on least developed countries (LDCs) is however a promising aspect.

Apart from the fellowship programme's contribution to the "new knowledge" output, the bigger share of outputs fall into the category "trained researchers and other professionals". Some 80% of the fellows of the ICS were rather at the receiving end, i.e. they were trained and/or made aware of state-of-the-art technology and science in specific areas. The most important benefits of the fellowship from the fellows' point of view are the opportunity to work in an international team and the scientific knowledge acquired. Knowledge factors and skills/experience factors are considered equally important. Overall there is a high degree of satisfaction with the quality of training provided by the ICS to the fellows (see survey).

Research

ICS research is expected to contribute to both core outputs of the ICS (new knowledge and trained researchers) as well as to all three main outcomes, as outlined in Diagram 2.

The research programme of the ICS has been characterized by a large number and variety of research projects. In the 2007 Work Programme, a total of 17 research and 2 cross-sectoral programmes were included, with an average budget of approximately euro 200,000. The Work Programme 2008 encompassed 10 research programmes and a total of 24 projects. The ICS management recognized that the wide scope of ICS research presented a barrier to effective research and started a process to focus ICS' work on a reduced number of priority research areas. As a result, the 2009 Work Programme contains only 4 core research programmes and one cross-sectoral programme. Under these 5 programmes a total of 10 projects were planned.

In the past, most scientific outputs of the ICS were produced in the area of chemistry (see table 3). The same is true for higher quality outputs, i.e. the peer reviewed contributions in scientific journals. Over the period 2000 to 2008, the chemistry area produced 42 scientific articles in peer reviewed journals and 20 contributions to books, proceedings & compendia. 7 peer reviewed articles were, as mentioned above, under preparation at the time of the evaluation mission, in February 2009.

**Table 3: Articles (from ICS database) 1991 - 2008**

| | No. Articles | % |
|---|---|---|
| Chemistry | 67 | 64% |
| Environment | 22 | 21% |
| High Tech & Materials | 12 | 12% |
| ICT | 3 | 3% |
| **Total** | 104 | 100% |

*Source*: ICS database, February 2009

The research of the ICS differs widely in terms of direct relevance to industry and thus also in terms of actual contribution to the development of a more science based industry. While some of the research in pure chemistry does not seem aligned to immediate industrial needs (i.e. it will take a long time before effects on industry can be expected), research in applied science is, by definition, directly related to industrial processes and products (e.g. chemical engineering). This means there is a trade-off between the more science-related and the more industry- related outcomes of the research of the ICS. A strategy that focuses more on pure research and scientific excellence needs to take into account that for the achievement of objectives in terms of industrial development there will be a need for the development of applications and immediate partners. So far, the ICS has only to a very limited extent developed a system of partnerships with institutions that have direct access to the private sector (e.g. technology transfer agencies or industrial research institutes). .

In the past, however, the ICS research activities were mainly devoted to applied science while the new strategy, as mentioned earlier, appears to make a step towards pure science (e.g. molecular design) including own research laboratories. This will require a careful analysis with regard to the instruments needed to ensure the effectiveness of ICS research in terms of science based industry and impact on industrial development.

Processing of scientific information

Through the processing of scientific information the ICS fulfills a scientific and technological reference function. This is supposed to contribute to all outputs and outcomes of the ICS.

A substantial part of the work of ICS staff and fellows has, in the past, not been related to pure or applied research but rather to collecting and analyzing available scientific information and making this available to partners in developing countries. Examples of such outputs and of publications produced are:

- Available technologies for local building materials (2008)
- BIO-FUELS: Technology Status and Future Trends, Technology Assessment and Decision Support Tools (2008)
- Extraction Technologies for Medicinal and Aromatic Plants (2008)
- Laser technologies: a step forward for small and medium enterprises (2008)
- Renewable Energy Technologies for the Production of Bio-Fuels: Perspectives and Appropriate Technologies for African Countries (2008)

Between 2006 and 2008 a total of 23 similar publications were produced[18]. A review of the topics shows that approximately 50 per cent of these publications are in areas of direct relevance to UNIDO (renewable energy, POPs, Biofuels) and the remainder are at least partly relevant to UNIDO's mandate (medicinal plants, laser technologies for SMEs, etc.), thus were likely to contribute to the achievement of UNIDO's programmatic objectives.

Interviews with representatives of relevant UNIDO technical branches revealed that the ICS contributions were considered to be useful inputs into UNIDO's technical cooperation and global forum work. The most prominent examples from the recent past are outputs in the field of Cleaner Production, Persistent Organic Pollutants (POPs) and Coastal Zone Management. A publication on state of the art technologies in the POPs area, for example, helped UNIDO to demonstrate its competence in this field. This was in important factor that enabled UNIDO to become an important partner of the GEF, in the POPs area. But, little is known about the actual utilization of publications by clients in developing countries or on any effects.

The processing of information has also led to some specific outputs/instruments of the ICS like the "Decision Support Tools" (DST). These are software-based tools that facilitate decision making with regard to choices regarding technologies and methodologies. Some of the older DSTs are still available on the ICS website. In those allowing for the registration of projects, no projects have been registered, suggesting a rather limited utility and outreach of these tools. The newer DSTs, in fields of cleaner production and sustainable chemistry, are not yet available on the website or disseminated in any other way and no evidence is available to assess their utility.

From the above analysis and from interviews with ICS staff and fellows it can be concluded that processing of scientific information has produced more tangible results

[18] See ICS webpage, publications, scientific books, May 2009

than has been the case for research. The former equips fellows with the latest scientific know-how and produces documents that can be used in UNIDO global forum events. This activity can be considered to have significantly contributed to the outputs “new knowledge” and “trained researchers and professionals”.

### Short term training programmes, scientific and expert group meetings and conferences

Trainings and meetings are mainly supposed to contribute to the capacity building and awareness outcomes of the ICS. The objectives of individual training events are stated in very generic terms in brief the documents justifying the trainings. They are mostly related to the overall objectives of the ICS.

The Annual Report 2007 lists a total number of 27 training programmes and workshops with an average duration of 3 days. Only one of these workshops was carried out in Trieste, the remaining took place in developing countries, all over the world. Furthermore, 3 Expert Group Meetings and one scientific conference are listed in the 2007 Annual Report.

In 2008, a total of 22 training programmes, workshops and conferences were implemented with an average duration of 3 days. 8 events were carried out in Italy and the rest in different developing countries, among them 4 Least Developed Countries (LDCs) such as Zambia, Senegal, Mali and Tanzania.
The ICS uses the terms conferences, expert group meetings, trainings and workshops interchangeably. A review of the content, participants and duration of the events under the different titles did not reveal any significant differences.

In 2008 these scientific events welcomed a total of 766 participants from developing countries. The ICS has collected evaluative feedback from the participants and summarized the results. A review of a randomized sample of training evaluations from participants showed that there is a high level of satisfaction among participants with most of them giving high ratings to the quality of lectures and the scientific training content as either excellent or very good.

Beyond the participants’ feedback are the reports available on these events. However, while these reports describe well the content of the workshops and summarize recommendations and conclusions, there is no information with regard to the actual effects or results. For example, the feedback forms do not include questions on how likely the know-how will be used to develop or introduce new technologies or on how likely the new issues/knowledge will be included in the teaching and research of local universities. Also, the final reports prepared by the responsible ICS managers do not indicate how the events contribute to the overall objectives of their respective areas. For example, often it is stated that a training event has expanded the network of the ICS in developing countries. But it is not clear why the expansion of the network is useful per se.

In light of the above, it is not possible to assess the effectiveness of the scientific training events in terms of the ICS expected outputs and outcomes. However, it should be noted that the relevance of the issues addressed in the different events can be considered high. A quick review and comparison of training topics with UNIDO service areas revealed that most of the topics are somehow related to industrial development.

### Other activities

In addition to the core activities described above, the ICS has carried out the following activities and produced the following products:

| *Activity/products* | *Evaluation assessment* | *Contribution to output* |
|---|---|---|
| ICS webportal | Good quality, up-to-date information, resources on all scientific events (list of participants, all presentations, final reports, etc.) | New knowledge available for wider audience |
| e-learning | Is becoming more important, several e-learning products available on DVD, good quality | New knowledge available for wider audience<br>Trained researchers |

## Outputs to outcomes

There is no consolidated information available on the outcomes resulting from ICS outputs, nor indicators formulated for assessing the achievement of outcomes. For the purpose of this evaluation, proxy indicators were formulated and used. The proxy indicators used were;

- The criteria used for identification and selection of fellows which should shed some light on the likelihood that ICS fellows will contribute to one or several of the ICS outcomes;
- the linkages of ICS to industry in developing countries shows how well ICS is positioned to respond to their needs or to contribute to science –based industry ;
- the ICS policy on intellectual property and technology transfer, as an indication to what extent ICS can contribute to a more science based industrial development;
- the extent to which ICS has established solid partnerships with scientific and research institutions in the industrialized world indicates as an indication on how effectively ICS can provide access to and disseminate scientific and technological know-how;
- the extent to which ICS has established solid partnerships with scientific and research institutions in the developing world as an indication of capacity building

With regard to the last two points, it should be noted that partnership building is an important aspect of many ICS activities and outputs (scientific events, research, fellowships). However, so far it has not been singled out as a strategic activity of the ICS thus it is not monitored and little can be said about its effectiveness.

*Is the ICS contributing to more science-based technology?*

As mentioned above direct collaboration with the UNIDO branch (PTC/EMB/SCU) took place in the area of Persistent Organic Pollutants (POPs). The ICS produced a compendium of state-of-the-art non-combustion technologies for POPs destruction. Since, UNIDO has built up a considerable portfolio of technical assistance projects in this field and amounting to between USD 25 to 30 million. Given the innovative nature of these POPs projects it can be assumed that at least some of these technical assistance projects are leading to the adoption of more science based technologies in developing countries.

Equally important has been the role of fellows in the achievement of a more science-based technology development. ICS fellows can be considered as main agents to disseminate ICS outputs to developing countries but so far they have been mostly recruited from scientific and government institutions. The future ICS strategy is expected to put more emphasis on the scientific profile of fellows. This might reduce the effectiveness in terms of promoting industrial applications.

The ICS has, so far, not had a policy with regard to intellectual property rights (IPR) and patents. No evidence has been found to indicate that ICS research has lead to patented technologies or products. The ICGEB, on the other hand, has had some 40 patents filed and 70 technology transfer agreements concluded during the period of operation of the ICS (1989 – 2008). In principle, patents can be both a tool and a hindrance for technology transfer. It depends on how they are used and what the objectives are. For example, a patent can be used by the ICS to ensure free access of developing countries to a certain technology, avoiding the patenting by for-profit agents. To illustrate this, table 4 shows how many granted patents and patent applications for influenza genome related patents were assigned to for-profit corporations and non-profit organizations. In other cases the involvement of private companies might be exactly the right way to ensure that a certain technology (e.g. for the manufacture of malaria medicine) will be applied on a large scale and benefit the population at large. Regardless of the specific solutions required case-by-case, the complete absence of a policy on IPR means that the ICS forgives an opportunity to make the ICS research more effective, i.e. that research results are incorporated in new technological developments.

**Table 4: Patents and patent applications for influenza genome related patents**

| Document Type | Corporation | Non-Profit | Total |
|---|---|---|---|
| *Grants:* Nucleotide claims | 9 (75%) | 3 (25%) | 12 |
| *Grants:* Amino Acid claims | 9 (45%) | 11 (55%) | 20 |
| *Applications:* Nucleotide claims (H5N1) | 7 (54%) | 6 (46%) | 13 |
| *Applications:* Nucleotide claims (non-H5N1) | 1 (25%) | 3 (75%) | 4 |
| *Applications:* Amino Acid claims | 40 (70%) | 17 (30%) | 57 |

*Source:* http://www.patentlens.net

As mentioned above, most of the institutional partnerships of the ICS, in developing countries, are with academic and other research institutions and no evidence has been found of any systematic partnering with the industrial sector. It is equally important to note that the promotion of linkages between the academic partners of the ICS and industry is not part of the present ICS agenda. The apparently very limited direct and indirect linkages of ICS with industry in developing countries are found to be contrary to a more science based technology development.

Are there expanded know-how, awareness and interest in defined research areas?

The main beneficiaries of the ICS (fellows and training event participants) value the quality and relevance of the know-how transferred. This is obvious from the trainings feedback forms and has been confirmed through the survey of ICS fellows. 94% of the

fellows claim that they have actively promoted their research topic in their home country. The promotion of the research subject in the home country was mainly done through informal networking with colleagues and peers, teaching and training events. The establishment of research teams also happened in a few cases.

Based on a review of the scientific training events carried out in 2007 and 2008 it can be concluded that the ICS has developed a capacity to reach out to institutions, researchers and other interested professionals in developing countries. The initiatives in the area of e-learning and the ICS web-portal further contribute to a wide dissemination of know-how in the developing world.

Available evidence suggests that the ICS is contributing significantly to the development of awareness and expanded know-how in certain scientific areas. This positive effect is, however, constrained by the broad range of scientific areas covered by the ICS.

### Has the ICS contributed to strengthened scientific capacities in developing countries?

According to ICS reports, 100 per cent of the fellows trained by or through the ICS returned to their home countries and a high proportion is working in positions that allow the application of the new know-how. The survey of fellows indicates that 73% of the fellows continue working on their research subject in their respective home countries. This might indicate a good degree of effectiveness at the outcome level. However, nothing is known about the actual effects on institutional capacity of the participating institutions. No self assessments and no monitoring information are available in this regard.

The survey also indicates good results, at the outcome level, with regard to the incorporation of research findings in educational and capacity building initiatives. 45% of survey respondents report that ICS issues have been included in teaching materials and curricula for seminars.

The broad range of research topics promoted and the lack of a partnership strategy of the ICS, however, represent important limitations to the effectiveness of capacity building interventions of the ICS.

## Outcomes to impact

The analysis of the impact of ICS interventions focuses on the question to what extent modern technologies, expanded know how and strengthened scientific capacities have actually helped to enhance industrial development in developing countries. While the present evaluation is not an impact evaluation in its own right, the following is an attempt to assess the likelihood of impact of ICS in relation to the achievement of developing country development objectives.

### Impact on industrial development

There is no evidence at the level of outputs and outcomes that would suggest any significant effects of the ICS work on the sustainable industrial development in the partner countries. One reason, as argued above, the ICS has not been very effective in achieving the first outcome-level objective, which is the one most directly related to the industrial development and namely; more science based technology development. In fact the evaluation team found little information indicating that the ICS has contributed to the

development of industrial technologies. Neither is there any indication that the relatively good results for the other two outcomes, more specifically capacity building and increased awareness, have led to any substantial industrial development in partner countries. The latter is confirmed by the survey of fellows. 73 per cent of the fellows do not report any significant commercial or industrial impact of their fellowship on the industrial development in their home country.

There are several conditions that need to be in place in order for the outcomes to lead to industrial development. The most important one is that the strengthened research capacities are of direct relevance to industry. Secondly, for capacity building to lead to industrial development, relevant technologies need to be in line with the actual demand of industry. Little is known about this possible match between technology demand and supply with regard to ICS activities. But it is evident that the ICS has not sufficiently incorporated the demand dimension into its planning processes.

On a positive note, it merits to be mentioned that there are indications that, in Mexico, NCPC staff is applying ICS transferred knowledge when assisting SMEs and that this has contributed to more environmentally sustainable industrial processes or energy savings.

### Other impact

Several of the past and planned research activities, focus on the discovery of drugs for so called “orphan diseases[19]”. If this research contributes to the discovery of new, effective drugs, a considerable developmental impact could result, leading to the improvement of the lives of millions of people. This is an example on how ICS could, in the long run, produce significant impact, without having any role in sustainable industrial development. Similarly, the involvement of ICS in the field of geothermal energy might lead to improvements in general energy accessibility in many countries.

To achieve this kind of impact, a pure science/research driven strategy might be appropriate. But in this case, UNIDO would probably not be the most obvious partner for the ICS and, for example, the WHO or UNESCO might be better placed to provide the ICS with needed support and link it efficiently to partners in developing countries.

Impact indicators are largely absent in the ICS Work Programme. Moreover, under the present Work Programme there are very few objectives formulated beyond the output level, thus it is difficult to access how projects are expected to contribute to or have contributed to higher level objectives. Moreover, ICS has, in the past, generally reported on activities implemented and outputs produced but not on results in terms of achieving outcomes or impact. This was also true for the self evaluation exercise carried out in 2008.

ICS staff, moreover, conveyed the message that it is not possible to report on impact since this can only be assessed a few years after a fellow has returned to his home country. True enough, but it can also be argued that, it would be difficult to assess impact, even at a later stage, since there are no baselines, objectives or indicators against which impact can be assessed. In addition the supply orientation of many ICS programmes and the fact that there are not always a direct relevance to the research agenda of the home institution or to the needs of the industry in the home country, make it more difficult to obtain and measure impact.

[19] A disease which has not been "adopted" by the pharmaceutical industry because it provides little financial incentive for the private sector to make and market new medications to treat or prevent it.

## Conclusions on effectiveness

The impact of the ICS on industrial development is likely to have been limited and this is partly due to the limited resources at its disposal but also due to a weak linkage with the industrial sector in developing countries and a lack of a ICS strategy for technology transfer for industrial development.

The effectiveness of ICS in terms of purely scientific outputs and outcomes will benefit from its new strategy and in particular on a reduced number of research areas. But, it harbors the risk of a limited effectiveness with regard to science based technology and industrial development in developing countries.

The potential of the ICS to contribute to capacity building in developing countries has not been fully exploited. Reasons are a dispersed research portfolio, the absence of a partnership strategy and the fact that the limited ICS resources have been spread too thinly and not strategically.

It has mainly been the chemistry area that has produced high level scientific outputs but their effects are not known. This will continue and substantial funds will in the next couple of years be devoted to Drug Design, where it should be noted, are many ongoing large scale research programmes world wide and the value added of ICS is uncertain. The environment and high technology areas have, in the past, been more active in the field of technology transfer and middle-level research (e.g. collecting state of the art information on certain scientific issues and conducting technology management trainings) but also here information on outcomes and effects are missing.

In the past, the ICS fellowship programme has been more effective in training researchers and professionals from developing countries than in its contribution to the generation of high-level research outputs.

# 9
# Efficiency

In this chapter we will discuss efficiency or how economically resources and inputs have been converted to outputs and results. In view of the relatively limited financial and human resources at the disposal of the ICS, the need to use resources in an efficient and cost effective manner is uncontested. The ICS management recognizes the need to focus in order to not spread available resources too thinly and to identify best practices and competitive implementation modalities. The evaluation team noticed, however, the absence of output-based budgeting making it difficult to assess the efficiency or cost-effectiveness of ICS interventions or to feed past results into plans for the future. Criteria for budgetary allocations between programme areas and projects are missing. One member of the International Scientific Committee, met by the evaluation team, was not aware of the budget available for different programme areas.

The rational of the ICS is that insufficient research capacities in developing countries can be overcome by providing scientists from developing countries with new knowledge and training and access to state-of-the-art equipment and facilities, relevant to the development of science-based industry. Is this hypothesis correct and has the ICS proven to be an efficient vehicle in these respects?

The analysis of ICS efficiency will focus on the following issues:

a) the appropriateness of the institutional set-up and ICS structure
b) the overall performance of the ICS in delivering various outputs and achieving its objectives
c) the efficiency of the different tools used by the ICS (fellowships, Expert Group Meetings, research etc.) in the delivery of outputs and outcomes

## The appropriateness of the institutional set-up and ICS structure

In order to fulfil its mandate and achieve its objectives the ICS has been established on a long term basis, as a semi-autonomous institution but is at the same time operated as a UNIDO project, thus being a kind of hybrid. The institutional features of the ICS are characterized by the following;

- the long term perspective
- the operation on the basis of recurrent annual work programmes instead of a project document
- the relative autonomy and distinct identity
- long-term staff and organizational structure

This institutional set-up has many advantages since the mandate of the ICS requires long- term partnerships, continuous in-house competence and activities and established processes and administrative capacities to implement training and fellowships programmes. At the same time, the efficiency of the ICS has been significantly reduced through a number of constraints which will be discussed below.

The, de facto, one year project status and predetermined and fixed annual budget, is a detriment for long term and flexible planning and poses constraints in terms of resource efficiency. The level of implementation, in terms of budget expenditure, has often been lower than what has been planned and for several years a significant portion of the allocated funds has not been spent and considerable savings have been accumulated. For 2008 alone, the total level of savings was approximately euro 1.8 million or 27 percent of the budget. This is also an indication of the limited capacity, in the past, to implement the resources provided to the Centre. At the same time the, more or less fixed annual budget, is a major constraint for growth, should this become warranted.

The ICS also faces constraints with regard to contracts. Due to the annual budget allocations, contracts for staff and fellows cannot be extended beyond December. For example, ICS fellowships need to end in December often to start again in February the following year but with obvious cost implications and delays due to the need to arrange for travel from and to Trieste. There does not seem to be any immediate solution to this problem. This problem, unless solved, will have important implications for the viability of the new ICS strategy, which centres on the recruitment of internationally renowned scientists.

The ICS has established an ambitious Work Programme for the future and it is questioned whether this is realistic in view of the relatively limited funding at its disposal and considering a rather weak implementation capacity. The present annual core budget of euro 5 million is expected to prevail the next couple of years. In addition, the ICS plans to raise substantial additional external resources to overcome the constraint in terms of resource allocation and negotiations are ongoing with the EU/FELICS Programme. However, with the current staff resources and organizational set-up, a growth in implementation is bound to be challenging. The recruitment of additional staff is being envisaged, to cover new scientific areas and to develop the critical mass needed to function as the envisaged “centre of scientific excellence” and this issue will be further discussed below.

Another related issue is the tendency of the ICS of spreading resources very thinly by implementing a relatively large number of unrelated projects in a variety of research areas. However, in terms of focus, the ICS Work Programme for 2009 is a big step forward as it includes a reduced number of projects and scientific areas. This is likely to increase the overall efficiency of the ICS and allow for economies of scale in the implementation of activities. Still, there will be as much as four core scientific programmes, encompassing a large number of projects.

As a UNIDO project, the ICS forms part of the wider UNIDO network and interacts with staff at headquarters and in the field. There are actual and potential synergies and complementarities with UNIDO in that ICS supports or complements UNIDO´s Technical Cooperation (TC) and Global forum (GF) Activities with scientific expertise and research activities and provides training in support of UNIDO’s TC programmes. In the past there has been close cooperation with some UNIDO programmes, such as the Cleaner Production and POPs Programmes. These synergies have the potential to significantly contribute to the efficiency of the ICS and of UNIDO. However, this potential for increased efficiency has not been exploited to any significant extent and the limited integration of ICS with UNIDO is an efficiency issue touching both entities, facing similar resource constraints and zero growth budgets.

So far, the ICS has only to a limited extent served as an extended arm of PTC, contributed to UNIDO’s Global Forum function or contributed to the achievement of UNIDO’s strategic or programmatic objectives. It is also noticeable that ICS Work Programmes and budgets do not provide information on how ICS outputs will contribute

to UNIDO objectives or the extent to which and how UNIDO resources will be used in ICS project implementation. However, the evaluation team took note of the fact, that in many cases, UNIDO staff have contributed to conferences and meetings organized by the ICS. This is likely to have contributed to the cost-effectiveness of the ICS and to achieving the Global Forum function of UNIDO.

As ICS also covers areas that are not covered by UNIDO, such as geothermal energy, drug design and Nanotechnology and it can in these areas be said to complement UNIDO and to bring in complementary expertise. This can also bring about efficiency gains to UNIDO (and to the ICS) but for this to occur there need to be common strategies and objectives. As mentioned above, there is presently little alignment of the work programmes of the two institutions.

The efficiency of the ICS is clearly enhanced by its incorporation in the Trieste System and the facility in accessing and interacting with the Trieste and Italian scientific resource base and this concerns both national and international institutions. The fact that external research facilities (primarily in Trieste) have been made available to ICS and, more specifically, to researchers from developing countries has in many aspects been a cost-effective approach. The ICS is also in a good position to get access and take advantage of new knowledge and research results generated by other institutions that are part of or are related to (e.g. University of Trieste) the Trieste System. The fact that the ICS works with a network of partner institutions has reduced the need to establish in-house capacities and facilities (both for the ICS and for partner institutions in developing countries) and contributed to cost-effectiveness. There might, however, be efficiency losses in terms of limited demand-orientation of the research undertaken or research capacity developed as fellows often need to align their research to the ongoing ones. This year, the ICS is establishing some in-house research facilities for the Rational Drug Design component but for other programme areas, such as Biofuels and Earth Sciences there will be a continued reliance on external facilities, in the short and intermediate timeframes.

The ICS also collaborates with a large number of institutions in developing countries but no formal networks have been established and there is an absence of a networking strategy. The need for thematic networks has been recognized by the current management and the creation of a network of “centres of excellence” is envisaged. This is likely to have positive effects on the overall ICS efficiency and will further expand its access to human resources.

The ICS is equipped with an UNIDO imprest account and has full access to Agresso. This certainly facilitates administration but it is argued that the processes in place are more suitable to a project than to an institution. For ICS the same procedures are being applied as with any other TC project, big or small, of UNIDO. For example, for training programmes MODs (Miscellaneous Obligation Documents) have to be requested on the basis of estimated expenses, after approval invoices are collected and passed on to Vienna and only after a second approval can disbursements be made from the imprest account. An institution that has been operating for several years with a specialization in training and with a high level UNIDO staff administrative capacity (Managing Director at ASG level plus a P5) should be in a position to ensure compliance with UNIDO procedures in a more decentralized manner.

Finally, there is a need to reduce the overhead costs of the Centre. According to the 2009 Budget, 12.4 per cent have been allocated the Office of the Managing Director, which is comparatively high. For one of the other International Centres, in Trieste, visited by the evaluation team, the budget allocation for the Director General’s Office was 3 per cent while UNIDO, as another example, devotes 0,3 per cent of its Regular Budget to the Office of the Director General plus the Bureau of Organizational Strategy and Learning.

Moreover, 24 per cent of the ICS budget is allocated to Administration and Information while UNIDO's Programme Support and General Management Division is allocated 19 per cent of the Regular Budget.

At the present (and past) level of operation (size of the organisation, annual budget, volume of projects), it does not seem justified to have a Managing Director, at the level of Assistant Director General. In fact ICS, in terms of budget, financial resources and strategic positioning rather corresponds to a UNIDO branch. This is in no way a reflection on the competence of the present Managing Director, who has a long and relevant work experience and whose qualifications or competence are not being questioned.

## The overall performance of the ICS in delivering various outputs and achieving its objectives

The evaluation finds that the ICS is well placed to provide scientists from developing countries with training and access to state-of-the-art equipment and facilities. The access to the UNIDO network and the status of the ICS as an international UN centre contribute to UNIDO being well positioned to fulfil a broker function and linking up developing country scientists with state-of-the-art research facilities and to organize training events and expert group meetings. There is some doubt however to what extent the strengthening of third world research capacities or the events organized have been efficient means to develop science-based industries in the third world. There might be more direct approaches, taking the needs of industry as a starting point, to achieve this. Similarly, there is evidence that the ICS has been an efficient modality to strengthen the scientific and technological capabilities of developing countries but less evidence that this in turn brings about the creation and application of scientific knowledge.

The evaluation team appreciated the system of feedback from trainings workshops and seminars and that this is actually been adhered to for the majority of the events. There is also a basic monitoring system for the fellowship programme that collects basic information on fellows, subjects of research, etc. However, as evoked earlier, these monitoring instruments do not use outcome indicators, i.e. they do not provide information on what happens as a result of training programmes and fellowships, thus on the effects of partner institutions.

As to the allocation of budgetary resources between the different substantial programmes, sub-programmes and projects there is little information or transparency as to how the allocations have been made and or how the budgets will be used (in terms of activities, outputs and outcomes), thus on what implementation modalities will be used. There is likewise an absence of project documents, with distinct intervention logics, planned results and associated indicators to enable the validation of results and enable a proper monitoring. Neither does the ICS have its own internal appraisal system for new projects.

## The efficiency of the different tools used by the ICS in delivering outputs

ICS core outputs are related to a) new or existing scientific know-how being available to a wider audience and b) trained or more aware researches and professionals. The most commonly produced outputs of the ICS are research studies, trained fellows, processed scientific information, trained experts, Expert Group Meetings and seminars.

Research & scientific publications

The efficiency of ICS research and in delivering the related outputs have been high due to the substantial collaboration with Italian research institutes and the fact that the ICS has been able to benefit from external resources, mainly available in Trieste. There has also been in-house research undertaken but there is little available information on the actual outputs and the costs involved in producing them. This should be seen in light of the fact that research and the corresponding scientific outputs have often been "by products" of the ICS, often generated in the process of on-the-job training of research fellows.

Another area looked into is the dissemination and uptake of research findings or developed technologies. Normally, technology uptake or innovation requires interaction between scientific institutions and R&D departments of Industry but, so far, the participation of industry sector representatives in ICS activities is weak, which is bound to reduce the efficiency of the research undertaken.

On the positive side, the evaluation team noticed areas of complementarity and interdisciplinarity among the four "new" ICS core programmes, for instance, between rational drug design and Nanotechnology, between biostructures (drugs component) and biocatalysis (biofuels), between nanotechnology and innovative geothermal exploitation and between biomaterials (drug design) and Nanotechnology but there is no clear indication on how actual synergies will be achieved.

Changes for enhancing the implementation of research activities have been presented by the ICS management as part of the future strategy and include the establishment of research groups with highly qualified principle investigators and a new implementation model has been developed. The model builds on a centrally positioned Principal Investigator, under the supervision of a Supervisory Senior Scientist, benefiting from advisory services of experts and consultant and working with a number of long-term ICS fellows. There is, however, some uncertainty as to whether or not the ICS will be able to attract qualified researchers due to its project status and the inability to offer employment contracts beyond one year. This would severely affect the implementation of the Work Programme. The ICS management is looking into the possibility of establishing a Guarantee Fund for long-term appointments, in order to be able to attract "brilliant" scientists. The evaluation team also took note of the conducive and attractive Trieste environment coupled with the opportunity to work in an international institution and with good financial conditions, in fact considerably better than what European universities can usually offer.

Moreover, in the year 2009 new laboratory facilities will be developed within the ICS. The efficiency or cost-effectiveness aspects of establishing own laboratory facilities versus using facilities of other institutions merits further reflection and scrutiny. This does not only concern the physical facilities but also the accessing of senior researchers/scientists and tutors and there is some doubt as to whether or not the establishment of in-house research laboratories is warranted. It seems as if requests to place ICS fellows within other institutions in Trieste have, in the past, most often been met with a positive response but that external "fellows are not given the highest priority by the host institutions and that ICS fellows often have to adapt to the ongoing research programmes as opposed to working on "his/her own". There has, however, also been an issue of the absorptive capacity of the Italian research institutions and that in order to achieve impact, the access of fellows needs to be expanded. There are two ways to achieve this, increasingly work with institutions beyond Trieste and Italy and the expansion of in-house ICS research capacities.

The evaluation team also took note of the fact that the Action Plan for the Future puts more emphasis on research activities than capacity building and that the technology

broker role of the ICS will diminish. In the view of many interviewees, the rational/efficiency of undertaking in-house research as opposed to being involved in the transfer of scientific knowledge developed elsewhere merits more reflection.

Another concern, already evoked, is that the ICS is spreading its resources thinly among several research areas. While this issue has been addressed partially by the new Strategy, which reduced the number of research projects, the number of research projects remains high in light of the very limited ICS resources available for research work. This further increases the risk of low efficiency of ICS research.

Whether or not UNIDO, as an institution, is well placed to promote scientific research - thus coming back to the value added of UNIDO to ICS - needs to be revisited by impact studies and evaluations.

### Fellowships

In all, 47 fellowships were implemented in 2008 and there were 33 foreseen in 2009. From the annual report 2007 we learn that the direct cost of fellowships represents 7% of overall expenditures of the ICS but we learn little about the actual benefits. No information is available as to the total cost of the fellowship programme, including administration and support from ICS staff and consultants.

The evaluation looked into the issue of whether or not the “right” fellows - in view of the expected effects - were being selected. Fellowships are being advertised on ICS and UNIDO websites and there is a selection committee that reviews a shortlist of fellows. Italian embassies also channel fellowship requests. Priority has, during the last few years, been given to candidates from Africa. In 2008, 51 per cent of all ICS fellows were trained in Trieste, 44 in Italian institutions located outside Trieste and only 5 per cent outside Italy. This poses some question as to what extent the geographical proximity to the ICS rather than the academic profile determines where fellows will be placed.

According to the Report on the ICS-UNIDO Fellowship Programme (2008) there are three ways for identifying fellows: in consultation with UNIDO and UNIDO projects, fellows are being proposed by a partner institution and through advertisements. The ICS selection committee has the final word and is responsible for selecting the most outstanding candidate(s). It was noted that the possible impact of a fellowship on industrial, social or economic development was not a criterion for selection. It was also noticed that among the 3 categories of target institutions assisting the ICS in identifying fellows, none belonged to the industrial sector but were rather universities and governmental agencies. 40 per cent of the fellows, in 2008, were women.

The evaluation team noted that each of the fellows, present in Trieste at the time of the evaluation mission were following a programme in the area of technology transfer and management, offered by the ICS. There was a high level of appreciation expressed for the training but, at the same time, it was not an area that had been requested by the fellows. The ICS management is, however, initiating action to link the fellowship programme more closely to the identified needs of developing countries and respond to a request for specific knowledge or technology.

There is, within the available budget, a choice to be made between the number of fellows and the duration of the stay of the fellows. The stay of an ICS fellow normaly varies between three to six months. Many fellowship tutors would like to see longer periods of attendance, in order to allow for comprehensive capacity building and research projects. Also a higher level of preparation of the fellow is being demanded and envisaged to make the fellowship more productive. A preparatory phase at the ICS has proven to increase

the efficiency of the fellows. The ICS has recently established a new, highly appreciated, unit to provide support to fellows.

Despite the efficiency issues raised above, in principle, the fellowship programme is regarded as an efficient instrument for the ICS to transfer know-how to developing country scientists and researchers. It provides fellows with a possibility to acquire research skills through on-the-job training and the ICS is well positioned to provide this service, even without in-house research capacities. In addition, host institutions often benefit from the extra hands (and brains) and from the research outputs.

### Processing of scientific and technological information

This activity, while having been one of the main areas of ICS, is not referred to explicitly in ICS reporting. Thus, it is not possible to assess the actual efficiency in terms of delivery.

However, in principle, the evaluation team finds indications that this instrument is efficient for several reasons: a) no costly in-house research is required, b) fellows can actively engage in this activity without access to research infrastructure, c) the results can be used in training programmes, scientific events, publications and by UNIDO (if relevant) and d) since the instrument is not tied to any in-house research capacity new areas can be covered in response to demand from UNIDO or from developing countries, hence it can be applied flexibly, making the best use of available resources. Finally, and maybe most importantly, the dissemination of available scientific information is less costly than generating new knowledge.

### Training programmes and other scientific events, e-learning

In the past the ICS has organized a large number of short tem training programmes and Expert Group Meetings. A considerable number of beneficiaries (about 800 in 2008) have participated at a relatively low cost, since most of the trainings have been conducted in developing countries. It is difficult, however, to make an assessment of the efficiency of these events since their purposes have not been clear and the training is not an end in itself.

Many of the ICS planned workshops seem to be of a too short duration (1 to 5 days) to enable effective and efficient capacity building and, moreover, the efficiency might be reduced due to the absence of capacity building or knowledge transfer objectives.

In the future, through the e-learning component, a more wide-spread dissemination of ICS presentations and contents of workshops will be possible, thus ICS will reach a much larger audience than before (estimated at a factor of 10 to 20). Efficient and cost-effective dissemination will be ensured thought he development of CD- ROMS and the use of the internet. This is however a new area for the ICS with a need to acquire necessary competence and develop new systems and tools.

Phase one of the e-learning programme is scheduled for completion in December 2010. The objective is to increase from 1,000 real participants to 10,000 virtual ones. Phase two has the objective to provide easy and free satellite access and interactivity for all ICS related events through, for instance, teleconferencing and virtual laboratory meetings coupled with distant tutoring. E-tutors will be identified to replicate ICS training events in partner countries.

## Conclusions on efficiency

ICS operates both as an institution and as a project and its institutional set-up and procedures are often beneficial to one but not to the other. In addition the ICS suffers from exorbitant overhead cost, a thin spread of scarce resources and limited integration and synergies with UNIDO. On the other hand constructive partnerships with, mainly Italian, scientific institutions have enhanced the efficiency of the ICS.

General efficiency issues are found in the area of research (e.g. resources spread thinly over high number of research projects and to some extent in relation to the fellowships programme; too short and interrupted fellowships, fellows with weak links to industry or to applied research and a lack of demand-orientation in the selection of research projects.

Little can be said about the actual cost effectiveness of the different instruments and activities of the ICS. This is due to the fact that there is no cost accounting or results budgeting system that allows comparing the cost and benefits of different implementation modalities.

Weaknesses have, moreover, been found in the area of contracts, in the selection processes for fellowships and training programmes and due to the limited level of decentralization when it comes to administrative procedures. Moreover, the ICS is yet to develop linkages between the scientific and industrial communities and instruments in order to promote the uptake of research outputs, scientific knowledge or technology by industry.

# 10
# Sustainability

In this chapter we will discuss the financial, technical and organizational sustainability of the ICS. The ICS benefits from a stable and continuous Italian funding and can be considered as financially sustainable. At the same time the fixed and rather limited budget has not allowed ICS to expand and to develop in terms of excellence or in terms of core competence. Funding from sources other than Italy did not materialize. This has had as an effect that the ICS has not encompassed in-house technical competence in all its core areas but has in the past and this is likely to continue, relied on outside scientific expertise. The finding of the evaluation team is that the technical sustainability of the ICS is weak but if suitable principal investigators are found this will improve.

The new ICS Strategy explicitly mentions the fostering of long-term partnerships and the strengthening of a number of “centres of excellence” in client countries. The Strategy is likely to increase the sustainability of the ICS by establishing a number of institutional partners that have an interest in the continuity of the ICS and with home synergies could be developed.

The ICGEB was often mentioned by UNIDO and ICS staff members as a benchmark for the future development of the ICS, both in terms of financial and technical resources but also in terms of organizational sustainability and autonomy. In this context it should be noted that, contrary to the ICGEB, the ICS does not have its own constituency. The ICGEB is a recognized intergovernmental organization with 59 members and 20 additional countries have filed for membership. Still, the major part of the ICGEB funding is provided by the Italian Government.

The ICS does not, as yet, have an autonomous status but is functioning as a project under the management of UNIDO; hence it cannot be regarded as organisational sustainable. Full independence of the ICS has not been clearly defined as an objective; it has though been mentioned asone option for the future.

Sustainability of the ICS will depend on the future direction of the institution. A more independent ICS with a strong focus on in-house research will require a substantial increase of external funding to create the “critical mass” necessary for internationally recognized research. An ICS that is more integrated into UNIDO, linked to the organisation’s technical cooperation and global forum function could remain relatively small and could benefit from synergies with UNIDO and being linked to UNIDO technical programmes, in need of training or research.

# 11
# Strengths and weaknesses

Generally, it is difficult to assess past results of the ICS or what has worked or has not in generating results and impact and more precisely to what extent the ICS has been able to develop and strengthen the scientific and technological capabilities of developing countries. The main reasons are lack of verifiable objectives and indicators and the absence of results-oriented reporting. Below, follows nevertheless an attempt to highlight the main strengths and weaknesses of the ICS and this is followed by a table providing an assessment on how various performance variables will be affected by the new ICS strategy.

## Strengths

The ICS is addressing relevant topics and research areas. It benefits from a stable and continuous support of the Italian Government and has access to UNIDO resources and UNIDO´s expanded network of institutions involved in technology transfer. The ICS can thus tap into UNIDO resources and knowledge and benefit from its credibility and visibility. It is an internationally recognized institution and can offer attractive international salaries and fees. Moreover, the ICS forms part of the “expanded” Trieste System and can easily access Trieste-based resources and benefit from their research outputs.

The institution has a strong management and a clear vision for the future. Its E-learning project is attractive and futuristic. It is equipped with good physical facilities for training and research. In many ways the ICS complements UNIDO and can provide complementary services, within the areas of training and research.

## Weaknesses

The ICS has a broad research agenda, a large number of research projects. Projects and programmes suffer from vague objectives and weak intervention logics. It is constrained by limited budgetary resources, small staff resources and limited in-house scientific and technical expertise. The recruitment of qualified scientists is difficult due to its project status, short-term funding arrangement and constraints in offering more than a one-year contract.

The developing country focus and alignment to needs and priorities of developing countries need to be stronger. In addition, there are limited actual and potential synergies with UNIDO programmes and UNIDO has weak competence in many ICS thematic areas.

Table 5 provides an overview of the assessment of ICS’s past performance what changes can be expected through the implementation of the new ICS strategy (as indicated in the ICS Action Plan for the Future). This summary attempts to answer the question whether existing strengths are used as a solid basis for future operations and whether existing weaknesses are being addressed.

**Table 5: Summary of conclusions in the light of the new ICS strategy***

| | **Strengths** | **Status quo vs. response in new strategy** | |
|---|---|---|---|
| **Relevance** | Research capacity building for developing countries relevant in principle | Unchanged | |
| | ICS operates within a scientifically very well equipped area (Trieste System and universities in the region) | New strategy tries to strengthen further the relations to institutions present in the Trieste science area and beyond. | |
| | Fellowship largely perceived relevant by fellows | Fellowships will be organized more effectively in the future to improve performance (extra curricular advisor, better selection, more rigorous monitoring of results) | |
| | Some areas of direct relevance to UNIDO showed good level of cooperation (e.g. Cleaner Production) | These areas have been dropped in the new strategy.<br>Drug design and nano technology (as defined in new strategy) not directly/at present relevant to UNIDO | |
| **Effectiveness & impact** | Some tangible research outputs in chemistry area | Chemistry area will be strengthened further | |
| | Some anecdotal evidence of research carried over to industry | No evidence that ICS has learned from such cases to provide guidance to staff and fellows how to replicate such success cases, new strategy does not deal with this issue | |
| **Efficiency** | | | |
| **Sustainability** | Continuity of donor funding over almost 20 years | There is no guarantee that funding will continue, the new strategy does foresees new funding opportunities(e.g. EU) | |

| | **Weaknesses** | **Response in new strategy** | |
|---|---|---|---|
| **Relevance** | | | |
| | Scientific programme (not individual activities) based on a perceived, rather than an expressed demand from developing countries. No real developing country | Revitalized ISC provides inputs and recommendations for the ICS scientific programme, scientists from developing countries participating in identification of areas | |

| | Weaknesses | Response in new strategy | |
|---|---|---|---|
| | and industry constituency of the ICS | | |
| | Relevance of research and training activities for industry unclear | Remains a weakness | |
| | Unclear (or lack of) focus of the ICS scientific programme | Scientific programme is still very wide and not as focused as in similar research institutions | |
| | Interviewed experts and stakeholders have very different views on the supposed mandate of the ICS (technology transfer or research in areas not covered by ICGEB and ICTP) | New strategy very clearly defines the focus on own research<br><br>But the specific role of ICS within the Trieste System and vis-à-vis other international development institutions (positioning of the ICS) remains insufficiently defined | |
| | Relevance of ICS for UNIDO not always clear, few examples of cooperation and alignment with UNIDO activities | New strategy focuses on research, which might reduce the relevance of ICS for UNIDO even further, if not demonstrated that research is of tangible use for industry (even if this is in the medium term only) | |
| **Effectiveness & impact** | Very little scientific output (except chemistry) | New model will be applied to establish scientifically effective research groups around highly qualified principle investigators | |
| | Substantive value added of UNIDO to ICS and the opposite is limited. | UNIDO does not have a clear strategy on how to provide support to or on how to benefit from technology centres. Backstopping capacities at HQ are not sufficient. | |
| | Tools for knowledge and technology transfer and capacity building not well developed (except fellowships and short term trainings) | The two existing tools (fellowships and trainings) are kept and further developed. Fellowships better managed and training enhanced through e-learning.<br>But, other interesting tools (awards, innovation centres, cooperative research, etc. ) not envisaged. | |
| | Nothing known about the medium term effects of ICS activities on industries in developing countries | No improved monitoring system envisaged in the new strategy | |
| **Efficiency** | Yearly budget cycle reduces ICS capacity to recruit qualified scientific personnel | Remains unsolved, represents a major barrier for the implementation of the new strategy | |
| | Administrative procedures | No solution found so far | |

| | Weaknesses | Response in new strategy | |
|---|---|---|---|
| | cause damaging interruptions of the scientific activity (especially the re-recruitment of fellows after year break) | | |
| | Overhead cost of ICS extremely high in relation to budget for research and technology transfer | Remain unchanged<br>New strategy envisages expanded funding through external donors, to bring down the overhead ratio, but it will remain very high in comparison with similar research institutions | |
| **Sustainability** | Fixed nominal budget does not allow ICS to grow as needed | Fund raising envisaged in new strategy | |
| | Sustainability of results of training programmes not known.<br><br>Survey indicates likely sustainable results of fellowships. | No explicit reference to sustainability in the new strategy, no policy for monitoring of long-term effects and sustainability foreseen. | |

| * colors indicate how new strategy responds to existing strength & weaknesses | New strategy fully responsive | Some issues not addressed by new strategy | Serious problems in new strategy |
|---|---|---|---|

# 12
# Conclusions

ICS constitutes a meeting place and a venue for knowledge exchange and learning. Many individuals, from partner countries have clearly benefited from acquired knowledge and skills and the exchange of experiences. ICS has offered valuable short term training programmes, which have contributed to an increase in knowledge and fellowships catering for more long-term competence and skills development. At the same time, there is, so far, little information on effects in terms of promoting science and technology in the developing world or to what extent applied science and technological knowledge have been transferred and, maybe even more important, are being used by the industrial sector.

Recently, the ICS has been re-oriented towards a more scientific institution with an identity and visibility of its own and with four core research areas. Its research focus is being strengthened but, at the same time, there is limited interaction with the industrial sector which seems to limit the scope for industrial application. As a result, the actual and potential synergies with UNIDO are less pronounced. The need for increased collaboration and coordination with UNIDO, in order to promote the delivery of the "One UNIDO agenda" remains. There is also the alternative of ICS continuing to pursue the road towards scientific excellence in order to become an autonomous international scientific research institution and independent from UNIDO.

The present areas of activity seem relevant from a developing country perspective but are broad, the number of projects many in relation to available resources and there is uncertainty as to the whether increased budgetary resources will be made available. The Government of Italy is today the only donor financing the ICS core budget and should be complemented for its stable and long-term commitment. In order to get other donors on board, there will be a need to show results and to demonstrate usefulness of the various activities and outputs, be it fellowships, workshops or research studies and how various outputs contribute to the achievement of higher level objectives, of partner countries and of UNIDO. Moreover, there is a need to assess what ICS can reasonably be expected to do and to assign priorities.

The ICS has a new Managing Director, 2009 is a transitional year and the new mode of operation is not expected to be fully implemented until 2010. During the last twelve months, it has become a more focused organization with an ambitious strategy but there is still limited alignment to UNIDO's core programme and strategic priorities and the new strategy have weak linkages to the Medium Term Planning Framework and offer few opportunities for synergies with UNIDO TC projects and programmes. For instance, the largest ICS area of rational drug design does not fall within the present UNIDO core mandate and there is no internal UNIDO competence in this area. The ICS Work plan and the ICS project document provide little guidance on how synergies can be developed with UNIDO. At the same time there is little indication in UNIDO strategies and work plans on how ties could be strengthened with the ICS and ICS contribute to the achievement of UNIDO specific objectives. This has had as a consequence that the value added of UNIDO to ICS and of ICS to UNIDO remain limited.

It is thus not evident how the ICS contributes to enhanced scientific capacities in developing countries or how generated knowledge and research find or will find their way to and are/will be used by industry or institutions and contribute to the development process. The evaluation team also misses information on how the ICS has or could contribute to the development of capacities of applied research institutions in partner countries.

In the past, there was cooperation with UNIDO in the field of sustainable industrial development and Cleaner Production and actual synergies developed. Rather limited attention has, so far, been given to UNIDO's global forum function and the role of technology broker is being diminished.

# 13
# Possible strategic options for ICS[20]

According to the Draft Action Plan for the period between 2009 and 2011, the ICS mandate involves both research and technology transfer[21]. The Action Plan states that "the institutional mandate of the ICS is to promote the transfer of applied science and high technology from developed to developing and transition economy countries in order to achieve an economically, environmentally and socially sustainable industrial development." It is the duality of the mandate which includes both, technology transfer and proprietary research that causes difficulties. The issue which will be examined, in this chapter, is whether it is wise to combine technology transfer and research, and which resources and competencies are appropriate for these purposes. In addition, other possible routes for the ICS will be reviewed. From the experiences of the ICS and taking into account experiences of other research- and technology-related institutions in Europe, the evaluation team came up with four strategic options for the ICS;

- ICS as an institute of basic research in areas of interest for developing countries
- ICS as an institute of applied research for the industrial sector in developing countries
- ICS as a broker of technology transfer services between the developed and the developing countries
- ICS as a global forum for discussions and dialogue between developed and developing countries

Apart from the general strategic direction for the future of ICS, there is the question whether ICS should remain a part of the UNIDO system or whether it should become independent. In theory, all of four options outlined above can be implemented in both ways – obviously with different strength, weaknesses and requirements in terms of competences. In the following subchapters, each of these options will be explored in more detail, for the two alternative scenarios: the ICS as an integrated part of the UNIDO system and as an independent institution.

## a) ICS as an institute of basic research in areas relevant to developing countries

In this model, ICS would develop into a fully-fledged research institute focusing on areas of interest for developing countries with a department or unit focusing on technology transfer, much like most universities in the United States and in Europe. Importantly, the

[20] In particular, the strategic options have been developed on the basis of the following sources: Literature on innovation and technology transfer in Europe, Strategy documents available from ICS, in particular the Draft Action Plan for the Future, Discussions with stakeholders within UNIDO and ICS

[21] ICS (2007): Draft Action Plan for the Future

focus of ICS would be on basic research as defined in the Frascati Manual[22]. As part of this option, ICS could become a research institute that operates within UNIDO's mandate and provides technological and research competence where needed. That would mean a much closer thematic and institutional integration with UNIDO. For that purpose, a structured review of existing UNIDO research and technological needs (e.g. non combustion technologies in POPs, Biofuels conversion technologies, etc.), both from the perspective headquarters as well as from the field, would be necessary in order to identify existing gaps and to determine new priorities.

Another possibility would be for the ICS to become fully independent of UNIDO, focusing on research areas which are complementary to those of the other actors in the Trieste system. This option reflects the desire of the ICS to "reposition ICS within the context of the existing international scientific community in Trieste by establishing a scientific identity and consequent credibility". As for the first option, also here a gap analysis needs to be done in order to determine research priorities.

Both options very much correspond with the practice of technology development in Europe, where most universities have their own industrial liaison or technology transfer offices. The aim of these units is to promote the research conducted by the university to third parties, mainly industry.

There are obvious advantages and disadvantages to this model of technology transfer: The proximity of the technology transfer unit to the researchers ensures close links with them and potentially leads to greater familiarity with research projects and results which can be helpful for the transfer process. The strong inward orientation might affect, the relevance of their research areas and the efficiency of their marketing activities. The incentives to undertake transfer activities can be rather weak and lead to a sub-optimal interaction with industry.[23]

For the ICS, this could mean that the focus on research would lead to an inward-looking perspective, neglecting the real and changing needs of stakeholders in developing countries. This model comes close to ICS's own plans for its future, with its emphasis on in-house research. At the moment, the process of defining the ICS research agenda seems random and with little transparency. From the Draft Action Plan, it is not clear how the core topics have been developed or how they match with the UNIDO mandate or with the agendas of partner research institutes in Trieste and in developing countries. Regardless of whether ICS, as a research institute, remains integrated into the UNIDO system or is becoming independent, the research priorities need to be defined in a systematic manner and reflect the actual needs of key stakeholders.

In addition, ICS does not seem to have sufficient resources to conduct substantial in-house research. Experience shows that effective research organisations must hold relevant state-of-the-art competence as well as the necessary resources or be in a position to provide high level research services.

[22] See OECD (2002): *Frascati Manual. Proposed Standard Practice for Surveys on Research and Experimental Development.* - "basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. Basic research analyses properties, structures and relationships with a view to formulating and testing hypotheses, theories or laws."

[23] See INNO (2004): 'Technology Transfer Institutions in Europe'. An Overview.

## b) ICS as an institute of applied research for the industrial sector in developing countries

Another model would be for the ICS to turn into an institute of applied research[24] aiming at technology transfer to industry in developing countries. In that role, ICS would support the industrial sector and escort them 'one step beyond' their existing capabilities, in order to enable them to innovate or upgrade their technologies more, sooner and with less risk than would otherwise have been the case. In other words, ICS would act as an interface to the world of scientific and technological knowledge by translating this knowledge so that it can be applied by industry.

However, as for the previous option, both sufficient in-house research capacities as well as a stringent choice of research priorities are necessary. In addition, this option requires a substantial understanding of the needs of industry as well as some degree of direct involvement of industry sector representatives. In particular, the ICS would have to establish transfer mechanisms that are transparent to the potential user and capable of combining and promoting research results according to the needs of client enterprises.

## c) ICS as a broker of technology transfer services between developed and developing countries

In this model, ICS would act as a broker for technology transfer between industrialised and developing countries. Indeed, many technology transfer institutions do not collaborate with one or a few specific universities, but offer their services to both industry and research organizations at large. They act as brokers for university-industry relations. If this option was chosen, ICS could leverage on its existing relationships with European universities.

In Europe, there are many examples of such 'broker institutions'. One example is the Enterprise Europe Network which offers a 'one-stop shop' to meet all the information needs of SMEs and companies in Europe. Instruments include business partnership search within technology and business cooperation databases and fast access to information on funding opportunities. Moreover, the services include individual on-site visits to companies.

In addition to general business support and technology transfer services, there are institutions focusing on the transfer of technology in a particular area. For example, the Euro Institute for Information and Technology Transfer in Environmental Protection, which was founded by professional associations and targeting small and medium-sized producers, service providers and operators in the energy, water and environmental sectors. UNIDO itself runs a series of International Technology Centres focusing on technology transfer services in certain areas (e.g. ICAMT or ICHET).

Apart from ICS, all of the UNIDO International Technology Centres are located in developing countries. Experience with technology transfer shows that geographical proximity is essential and especially when targeting SMEs. In Europe, the Enterprise

[24] According to the Frascati Manual, applied research is defined as original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective. Applied research is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving specific and predetermined objectives. It involves considering the available knowledge and its extension in order to solve particular problems.

Europe Network discussed above has subsidiaries in all European countries. In addition, many countries feature regional and local business support services which are even closer to their customers. One example is the United Kingdom 'Business Link', which offers advice to business on a local and regional basis. Another option is for business support to be mobile. In Austria, the Telefit initiative consists of a team of experts on e-business organising activities and workshops across the country on a regular basis.

In addition, rather than concentrating on a particular sector or technology, service institutions can also focus on a particular type of services. In most cases, such organisations focus either on licensing and patents or on start-up and incubation services. For the ICS, one option would be to broker or promote research or knowledge (technology) developed elsewhere and another could be to focus on mobility-related services (such as the Fulbright program or the British Council's fellowship grants) as well as on short-term training events.

The importance of mobility for technology transfer is well recognised and is related to both the creation and diffusion of knowledge. Not only does mobility assist in the production and dissemination of codified knowledge, it is also an important means of transmitting tacit knowledge. In the broadest sense, tacit knowledge is any knowledge that cannot be codified and transmitted as information through documentation, academic papers, lectures, conferences or other communication channels. This kind of knowledge is more effectively transferred among individuals with a common social context and physical proximity.[25] As an example, UNESCO fellowships provide opportunities for Graduate and Postgraduate students to go abroad and pursue innovative training and advanced research in one or more of UNESCO's five major program areas[26]. Likewise, the Robert S. McNamara Fellowship Programme of the World Bank supports development through innovative research.

### d) The ICS as a global forum for discussions and dialogue between developed and developing countries

Another option for the ICS would be to abandon research and to focus exclusively on training and awareness-raising activities. Rather than acting as a broker for a large, heterogeneous and decentralized group of stakeholders, ICS could bring together stakeholders from the developing world around a few selected topics of relevance to both UNIDO and developing countries. For this purpose, researchers, policy makers, business people, representatives of educational institutions, NGOs etc. could be invited to the location of ICS for a seminar, forum or expert group meeting.

There are various examples of institutions with this mandate. One of them is the Aspen Institute in Berlin, which brings together international experts on a series of topics related to conflict management. Another example is the European Institute for Human Sciences, an independent institute for advanced study in the humanities and social sciences. Its objective is to bring together academics and intellectuals from Eastern and Western Europe into a common discussion.

This model has the advantage that it does not need substantial resources in the form of permanent staff, research laboratories and so forth. Nevertheless, it does need qualified researchers, able to develop attractive programmes. This model could help to position the

[25] See for example OECD (2008): The global competition for talent. Mobility of the highly skilled.
[26] education, natural sciences, culture, social and human sciences, communication and information

ICS as a facilitator between the scientific and the industrial world. Again, ICS could carry out this task in a stand-alone fashion or as an integrated part of UNIDO. The latter would have the advantage that UNIDO staff members from the research branch or the technical branches could be mobilized, which could increase the relevance for third world stakeholders and enable synergies with UNIDO's Technical Cooperation Programme.

## Conclusions

The chapter has reviewed a few strategic options for the future positioning of ICS and can hopefully serve as an input to future dialogues between ICS stakeholders. All the options have advantages and disadvantages and will have to be reviewed in light of the expected financial and human resources at the disposal of the ICS. Combinations of options are also possible in order to adapt to a wider mandate.

# 14
# Recommendations and lessons learned

## *Recommendations to UNIDO/ICS with the assumption that ICS will continue to be part of UNIDO*

- **The main objectives of the ICS should be aligned to those of UNIDO, focusing on knowledge and technology transfer to industry and on capacity development**

There is a need to define the objectives of ICS more clearly, in particular with regard to the ICS' role in sustainable industrial development. The main aim of the ICS should be to contribute to enhanced knowledge and capacities for the effective utilization of science to promote industrial development of developing countries.

To achieve these objectives the ICS should focus on areas relevant to UNIDO, using tools where it has proven strengths (such as fellowships, training programmes and expert group meetings) and technology transfer promotion.
ICS activities and objectives should be more aligned to those of UNIDO, such as to the MPTPF and of the technical branches and annual Work Programmes should be developed in close collaboration with technical branches, with the UNIDO Medium Term Programme Framework as one point of departure.

Research areas should be defined jointly with UNIDO's technical branches and training, research and global forum activities and events should be planned in collaboration with UNIDO technical programme staff. All ICS projects should specify how the project will collaborate with UNIDO technical branches and with other UNIDO institutions or offices. The entire UNIDO network should be incited to collaborate with the ICS, including other ITCs, the South South Cooperation Centres and ITPOs. In the past there had been valuable cooperation with environmental programmes, such as the CP programme and maybe this area of cooperation could be revitalized.

UNIDO technical programmes and auxiliary institutions such as ITCs should participate in the identification of research areas and suitable fellows and UNIDO projects (for instance in the POPs area or GEF projects) should aim at integrating research and training components and to collaborate with ICS on how to deliver the components. This should contribute to more problem oriented or rather problem solving research and research with direct linkages to UNIDO programmes.

- **The ICS Strategy and Programme should be aligned to developing country needs and priorities and specifically those of the industrial sector**

It needs to be ensured that the research undertaken or the knowledge transferred can be adapted to the situation of the fellow or trainee in his/her home environment and is in line

with identified needs and priorities of the sending institution and sending countries and can be applied.

The ICS Strategy, Programme and annual Work Programmes should be developed from a developing world perspective and in cooperation with partner institutions in client countries. Projects and related project documents should have clear objectives at the outcome level and be able to specify how outcomes will contribute to higher level impacts. Preferably, poverty perspectives should be discussed in Work Programmes and project documents.

The objectives of research projects, fellowships, training programmes, etc. should be aligned with strategic priorities of developing countries and respond to demands for capacity development. There should be more focus on applied research in order to ensure that generated research and knowledge will be of use to industrial sector. The views of partner institutions and industrial sector representatives should be solicited before capacity building and research activities and projects are decided upon.

- **The ICS Work Programme should be more focused in order to avoid that resources are spread thinly**

There is a need to keep the limited human and financial resources of the Institution in mind. Research programmes need to be adjusted to fit the level of resources and available expertise. The number of research areas should be reduced in order to arrive at a more concentrated portfolio, for higher impact.

- **More emphasis should be given to the broker function of the ICS (processing and dissemination of existing scientific information), as opposed to research-function (generation of new scientific knowledge**)

This would enable a more cost-effective ICS and could be easily by focusing on analysis and dissemination of research findings and knowledge being generated by various research institutions world wide. It would not require long-term investments in in-house research capacities.

- **The ICS should become more international**

The ICS should be linked up to all the major research organizations active in their mandated areas and access resources beyond Italy, when this is warranted. To this end a network of scientific partner institutions should be created.

- **A strategy for capacity-building should be developed and implemented for key institutional partners in developing countries**

Capacity development, in line with identified needs should be a central element of ICS's Work Programme.

- **Fellowships should be planned and implemented so that they can contribute to a process of change and development**

ICS fellows should be working on research projects that are in line with ICS's thematic areas but at the same time the applications for fellowships should clearly describe the applicants projects, how it will be established in the fellow's organization and how the ICS fellowship will contribute to its advancement and to industrial development.

- **The ICS should be more involved in bridging the science-industry gap in client countries**

To this end specific measures should be included in policies and work programmes. This could include clear selection criteria for partners and fellows to ensure linkages with the industrial sector. It could also include tri-partite fellowships incorporating universities and industries.

- **The International Scientific Committee should have representatives from the industrial sector, including from Industrial Research and Development (R&D) organizations**

- **The ICS Trieste should develop its theories of intervention: a clear intervention logic should be developed for all ICS programmes and projects and the expected impact should be clearly stated**

Even though ICS effects on economic and industrial development are not immediate but rather long-term, there is still a need to think through the results chain and develop an intervention logic (to be monitored and tested). Causal chains should not only encompass the development of scientific know-how but also how this know-how will reach and be taken up by industry. Also the actual and potential role of Industrial R&D functions needs to be covered and how ICS can complement research and training activities of UNIDO and, in addition, contribute to policy development. ICS needs to demonstrate how they contribute to the achievement of higher level objectives, including the Millennium Development Goals (MDGs).

In the present Work Programme there are very few objectives stated beyond the output level, thus generally difficult to trace how projects are expected to contribute to or have contributed to higher level objectives.

- **ICS should adopt RBM and results should be monitored and reported on**

ICS should report on results, beyond the output level. ICS needs to be able to show how their interventions have strengthened research capacities and/or have benefited industries in partner countries. Moreover, best practices in technology transfer and capacity development of southern partners should be shared within the ITC network.

- **UNIDO should incorporate the ICS in its organizational structure, planning and strategy documents**

At present the ICS appears in UNIDO documents as a project and it does not appear in UNIDO's organisational chart. This does not reflect the fact that ICS is de-facto operating as an institution (similar to ITPOs) with a distinct identity and being perceived by stakeholders as part of UNIDO. Thus, UNIDO should recognize the distinct role of ICS within the UNIDO network. In this regard UNIDO could assess the possibility to incorporate the ICS in the organisation's overall research strategy and in its strategic frameworks.

- **UNIDO should take greater advantage of ICS facilities: for example, the ICS facilities could be used for UNIDO Summer Universities**

This would offer opportunities of technical branches to use the ICS facilities and to further promote UNIDO's Global Forum function. Moreover it will offer opportunities for interaction between UNIDO and ICS staff and opportunities to develop areas of collaboration. The ICS is endowed with excellent research, conference and training facilities and these should be used in a more efficient manner, for higher impact.

- **South/South cooperation should be encouraged**

There should be more promotion of south-south and triangular arrangements as southern research institutions might be more similar to the conditions of the institutions of the fellows and the working conditions more replicable.

- **There should be an attempt to expand membership and donors and to develop longer-term funding arrangements**

An expanded membership would increase the international identity of the ICS and could pave the way for increased resources, for higher impact. The present short-term funding arrangements are unsatisfactory and needs to be reviewed.

### *Recommendations to UNIDO/ICS with the assumption that ICS will, in the medium term, develop into an independent research-focused institute*

**A UNIDO project document should be prepared to describe the cooperation between UNIDO and ICS from now to independence. This should include a clear exit strategy and the activities and outputs necessary to transferring ICS into an independent inter-governmental organization.**

The objective should be to develop the ICS into a centre of scientific excellence, similar to the role the ICGEB is playing today. In this scenario, UNIDO's role should, in the short term, focus on strengthening various technical and administrative aspects of the ICS.

If the ICS will continue to have a strong focus on in-house research, a clear strategy for IPR needs to be developed.

- **To increase overall efficiency of the ICS overhead costs should be reduced to the extent possible and administrative procedures should be made more congruent with the institutional nature of the ICS**

This would involve a reduction of the cost of the office of the Managing Director to achieve a more adequate ratio of overhead vs. operational cost. Furthermore the UNIDO procedures for contracts of staff and fellows need to be adapted to reduce interruptions of fellowships and allow longer term contracts for qualified scientists.

# Annexes

## *Annex I – Terms of Reference*

### Independent Evaluation of the International Centre for Science and High Technology (ICS) Trieste

### I. BACKGROUND

In March 2008, the UNIDO Executive Board mandated the UNIDO Evaluation Group (OSL/EVA) to, as part of its 2008/2009 Work Programme, undertake a thematic evaluation of International Technology Centres. Due to its size and strategic relevance, the International Centre for Science and High Technology (ICS) Trieste was selected to be included in this evaluation. This was also in line with a recommendation coming out of a meeting of the ICS Steering Committee, in April 2006. This independent evaluation of ICS will be undertaken as a free-standing project evaluation and, at the same time, serve as an input into the thematic evaluation.

The ICS was established in 1988 with the objective to promote high-level research and develop and strengthen the scientific and technological capabilities of developing countries in the creation and application of scientific knowledge. This objective was to be achieved by providing scientists from developing countries with training and access to equipment and facilities for research related to the development of science-based industry. Activities and events envisaged were training, research, workshops, scientific meetings, a scheme of visiting scientists and associates, cooperation with industry and relevant institutions and the transfer of technologies. According to the ICS Mandate, defined in the Institutional Agreement between the Government of Italy and UNIDO (signed in 1993) the transfer of applied science and high technology from developed to developing and transition economy countries would contribute to an economically, environmentally and socially sustainable industrial development.

The Secretariat, headed by a Managing Director, was to carry out its function under the overall guidance of a Steering Committee, consisting of two representatives of the Government of Italy, a representative from UNIDO and a representative of developing countries. An International Scientific Committee was established in 2008. The Centre is guided by annual Work Plans. A strategic Action Plan has, moreover, been prepared for the period 2009-2011.

The project is funded by the Government of Italy, through an annual special purpose contribution amounting to euro 3.6 million, including 5 per cent support cost.

### II. EVALUATION PURPOSE

The purpose of the independent evaluation is to enable the Government of Italy and UNIDO to have up-to-date information with regards to the following:

(a) the past and continuous relevance of the ICS and of the activities promoted, outputs produced and outcomes achieved

(b) the efficiency of implementation: quantity, quality, cost and utilization of resources, timeliness of UNIDO/ICS inputs and activities, and ICS management and coordination, including the roles of the Steering Committee and of the International Scientific Committee
(c) the extent to which outputs have been produced and objectiveness achieved, as compared to those planned (effectiveness)
(d) the impact and sustainability of results, effects and benefits

It is envisaged that the evaluation will focus on the results achieved by the ICS and its continuous relevance. The evaluation will also seek to draw lessons of wider application for the replication of the experience gained by the ICS for UNIDO's network of technology centres. The findings of the evaluation will feed into the wider thematic evaluation on technology centres, equally planned for 2009

## III. METHODOLOGY

The evaluation is to be conducted in compliance with UNIDO's Evaluation Policy and the Technical Cooperation Guidelines. It will assess the achievements of the Centre against its objectives and outputs, established in the Institutional Agreement (1993) and in annual Work Programmes and include a re-examination of the relevance of the objectives and of the design. It will also try to identify factors that have facilitated or impeded the achievement of the objectives.

The evaluation will be carried out through analyses of various sources of information including relevant ICS documents, action plans and work programmes, ICS publications, self evaluation reports, survey data, reports of Expert Group Meetings, workshops and training programmes, training material, feed-back forms of participants in workshops/seminars, reports from fellowship holders, minutes of meetings of the International Scientific Committee and of the Steering Committee and interviews with various stakeholders such as ICS and UNIDO staff members, representatives of the Italian Government and beneficiaries and through the cross-validation of data. Internet Surveys will be conducted and target past fellows of ICS and representatives of partner institutions. The emphasis of the analysis will be on the period covering the last two years.

The evaluation team will also visit partner institutions of the ICS in Trieste (e.g. University of Trieste), other international research institutions (ICTP, ICGEB) in order to assess actual or potential interactions and synergies with these centers and to draw from the experience gained by these centers.

The thorough analysis will include a review of relevant UNIDO policies and strategies, activities implemented, outputs produced, management mechanisms applied (in particular planning and monitoring) and project specific conditions. While maintaining independence, the evaluation will be carried out based on a participatory approach, which seeks the views and assessments of all parties. It will address the following specific issues:

## IV. EVALUATION ISSUES

### *Ownership and relevance*

The extent to which:

(i) The ICS mandate, function and research activities have been and are in line with the priorities of developing countries, UNIDO and the Italian Government and with the ICS Mandate;
(ii) The new vision and strategy is in line with the priorities of developing countries, UNIDO and the Italian Government and the ICS Mandate;
(iii) The research promoted and developed is being demanded, used and beneficial for developing countries;
(iv) The "right" participants were targeted for various events;
(v) The ICS mandate and the Institutional Agreement are still valid;
(vi) There are linkages to UNIDO technical branches and to UNIDO thematic priorities;
(vii) ICS activities have a link to UNIDO Technical Cooperation activities;
(viii) The ICS complements efforts of other national or international institutions, public as well as private;
(ix) Other donors contribute to ICS activities and/or there are other cost-sharing interventions.

### *Efficiency of implementation*

The extent to which:

(i) UNIDO and Government inputs have been provided as planned and were adequate to meet requirements;
(ii) The quality of UNIDO inputs and services was as planned and timely;
(iii) The ICS can be regarded as a cost-effective instrument for the transfer of knowledge and capacities in relation to applied science and the use of advanced technologies;
(iv) The least costly resources and processes were used in order to achieve the objectives;
(v) There was coordination with other UNIDO projects/programmes or branches/units, other UNIDO centres and synergy effects;
(vi) Counterpart institutions have fulfilled their expected functions;
(vii) ICS operational modalities; training programmes, Expert Group Meetings, workshops, publications and fellowships are cost-effective;
(viii) The selection of researchers, fellows and workshop participants followed established criteria;
(ix) The ICS uses a network of partner institution in academia and industry, including institutions in developing countries.

### *Effectiveness*

The extent to which:

(i) The outputs were produced and objectives achieved or are likely to be achieved;
(ii) Knowledge in applied sciences have been transferred and research capacities developed;
(iii) ICS contributes to science-based industries in developing countries;
(iv) ICS research reports are published in relevant international journals;
(v) Stakeholders from developing countries participate in ICS activities;
(vi) ICS is regarded as a centre of scientific excellence.

### *Impact and sustainability*

(i) Identification of the long term developmental changes or benefits (economic, industrial, environmental, social and developmental) that have occurred or are likely to occur as a result of the centre's activities;
(ii) Benefits of the promoted research in terms of achieving development goals or contributing to industrial development in developing countries;
(iii) Assessment of the use of research outputs (by institutions and enterprises) and of the capacities developed at institutional or individual levels;
(iv) Have ICS fellows and/or trainees contributed to improved performances of individual enterprises through technology upgrading.

### *Project coordination and management*

The extent to which:

(i) The centre management, the steering and scientific advisory committees and approval mechanisms of the centre/project have been efficient and effective;
(ii) The administrative status of the ICS is conducive to its role and function;
(iii) The UNIDO HQ based management, coordination, substantial guidance, quality control and technical inputs have been efficient and effective and are in line with present requirements;
(iv) Monitoring, reporting and self-evaluation were in place and carried out efficiently and effectively, based on suitable indicators for outputs and objectives;
(v) The budget and staffing are adequate;
(vi) There has been cooperation with other international technology centres and whether this has led to the achievement of objectives and synergy effects;
(vii) Gender and environmental issues are mainstreamed.

### *The future*

(i) What should be the future role and mandate of the ICS;
(ii) To what extent can ICS contribute to achieving UNIDO's strategic objectives and be part of "delivering as One UNIDO" or should be an independent institution?
(iii) Identification of lessons learned, benchmarks and good practices, to guide the development of all international technology centres.

## V. EVALUATION TEAM

The evaluation team will be composed of the following:

- Two representatives of UNIDO Evaluation Group
- One independent international evaluation consultant

The international evaluation consultant will be contracted by UNIDO. The tasks of the international evaluation consultant are specified in the job description attached to these Terms of References.

The members of the evaluation team should not have been directly involved in the design and/or implementation of any ICS related project. The staff of ICS Trieste as well as PTC staff at UNIDO Headquarters will provide support to the evaluation team.

## VI. TIMING

The evaluation is scheduled to take place in the period February to April 2009. The field mission for the evaluation is planned for the last week of February.

The draft report will be submitted within six weeks of completion of the field mission and shared with the Government of Italy, ICS Trieste and UNIDO HQ. A final report will be submitted within six weeks after receipt of feedback.

## VII. REPORTING

The evaluation team will present its preliminary findings to the ICS management, Steering Committee members, management at UNIDO Headquarters and to representatives of the Italian Delegation to UNIDO. A draft evaluation report will be circulated for validation and comments. The evaluators will take comments into consideration when preparing the final version of the report. The reporting language will be English.

The findings of the evaluation will be presented and discussed at the ICS Steering Committee meeting, scheduled for October 2009.

## VIII. BUDGET

The evaluation will be financed by the ICS core budget and the overall budget for the evaluation is estimated at euro 17.500. The various budget posts are;

- International Consultants euro 12.000
- Staff travel euro 3.500
- Sundries euro 2.000.

## *Annex II - Persons consulted*

**ICS**
- Mr. G. Rosso Cicogna, ICS Managing Director
- Prof. A. Falaschi, ICS Rector
- Mr. S. Giovanelli, Senior Programme Coordinator
- Mr. M. Ghribi, Scientific Officer, Earth, Environmental and Marine Sciences and Technologies (fellowship programme)
- Mr. S. Miertus, Area Chief, Pure and Applied Chemistry
- Mr. G. Longo, Chief, Environment Area
- Mr. G. Bertogli, Chief, High Technology and New Materials
- Prof. G. Tocchini-Valentini, Scientific Adviser, Italian Foreign Ministry and IBC Institute of Cell Biology, Member of ICS Steering Committee
- Group of ICS fellows

**University of Trieste**
- Prof. P. Fornasiero, Department of Chemical Sciences (biofuels),
- Prof. F. Benedetti and Dr. F. Berti (drug design)
- Prof. M. Pipan and Prof. I. Finetti (geothermal energy)

**ICGEB**
- Prof. F. Baralle, Director-General
- Mr. D. Ripandelli, Director, Administration and External Relations
- Prof. M. Giacca, Director, Trieste Component

**SISSA**
- Prof. S. Fantoni, Director

**ICTP**
- Prof. K. Sreenivasan, Director of ICTP
- Prof. C. Tuniz, Assistant Director

**TWAS**
- Dr. P. McGrath, Acting Programme Officer (on behalf of Prof. Hassan, Executive Director), Programmes and Public Information

**Synchrotron Elettra**
- Prof. G. Scoles (nanotechnologies)

**CBM**
- Dr. S. Kroll (nanotechnologies)

**UNIDO**
- Mr. D. Piskounov
- Mr. P Monga
- Mr. M. Garzelli
- Mr. R. Bredel
- Mr. H. Leuenberger
- Mr. R. van Berkel
- Ms. F. Lambert
- Ms. E. Tonda
- Mr. M. Eisa

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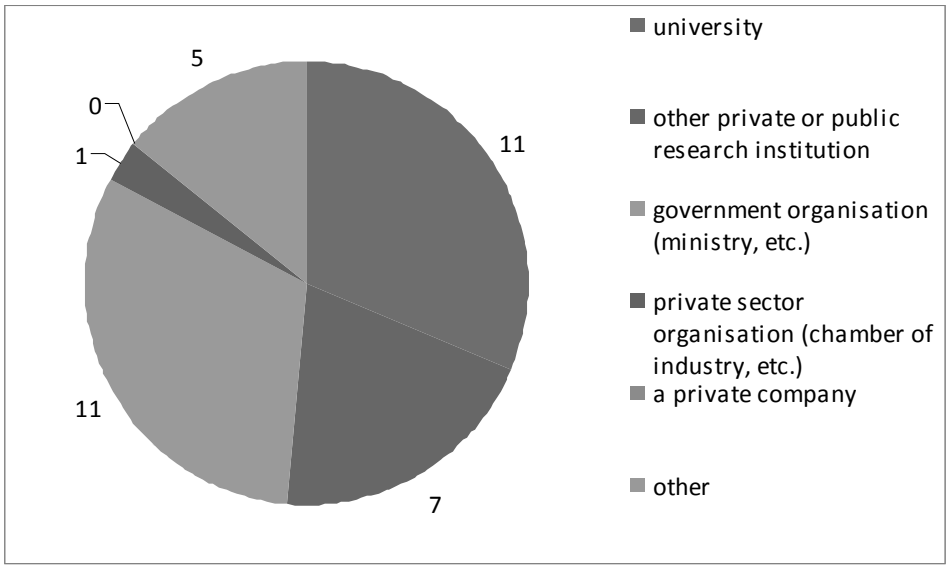
## *Annex IV – Analysis of the survey of ICS fellows*

**Independent Evaluation of the ICS and the UNIDO support to it**

Survey of ICS Fellows

| Survey universe and response | | |
|---|---|---|
| ***Returned*** | 34 | 43% |
| ***Not returned*** | 46 | 58% |
| **Total** | 80 | 100% |

### 1 Which type of organization sent you on the ICS fellowship?

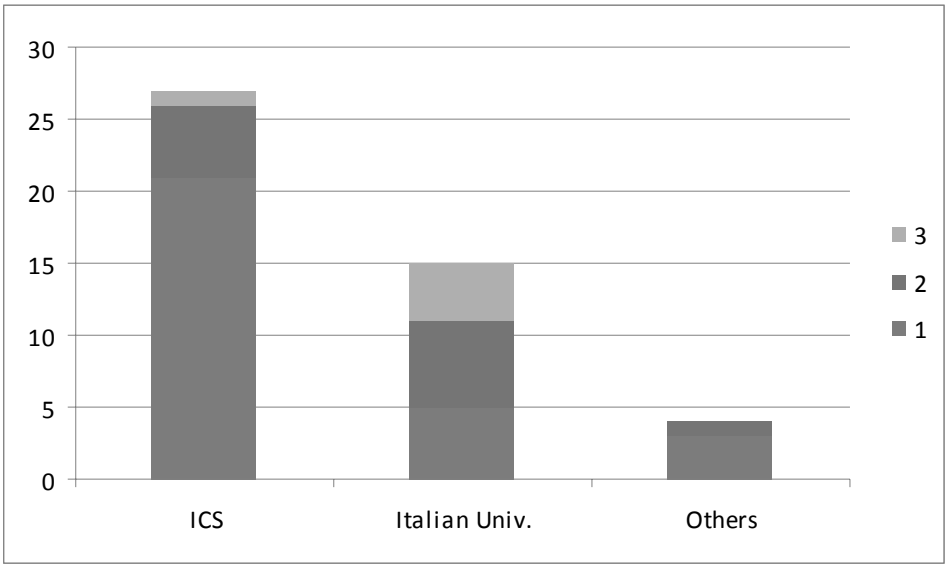



***Only about half of the fellows were sent to ICS by academic and/or research institutions. Quite a significant number was sent to the ICS by government organizations not related to research (Ministries, etc.).***

### 2 How many months did your fellowship last (please deduct any interruptions and state the net duration):

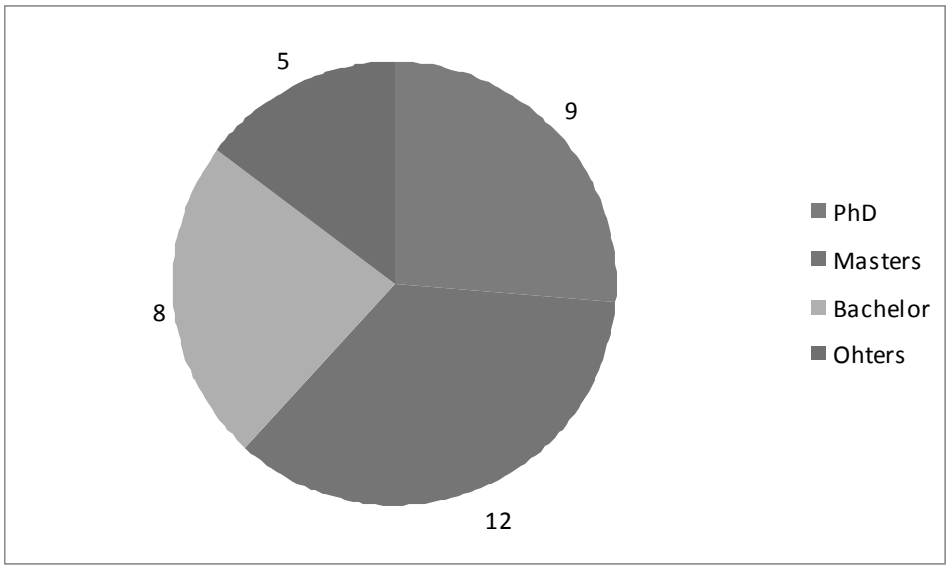
***On average, the fellowships had a duration of approximately 5 months (5.4 average, 5.0 median).***

**3 At which institution did you spend most of the time of your fellowship? Please rank in order of importance (1 being highest rank, 3 lowest).**



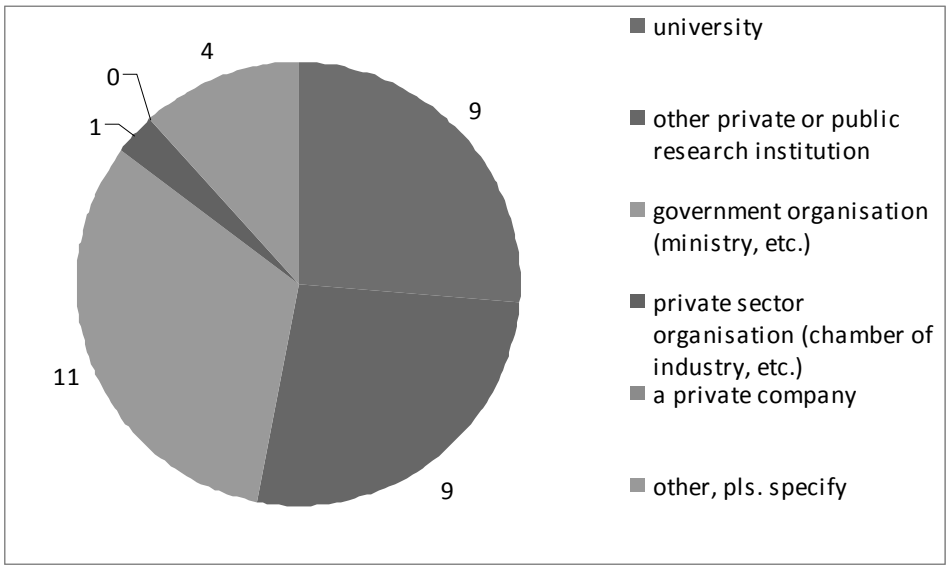

***By far most fellows spent most of their time at the ICS. 8 out of 34 spent most of their time at an Italian university or other (3) institution. This points towards a limited importance of outside institutions and the Trieste System for the operation of the ICS.***

## 4 What is your highest academic degree?



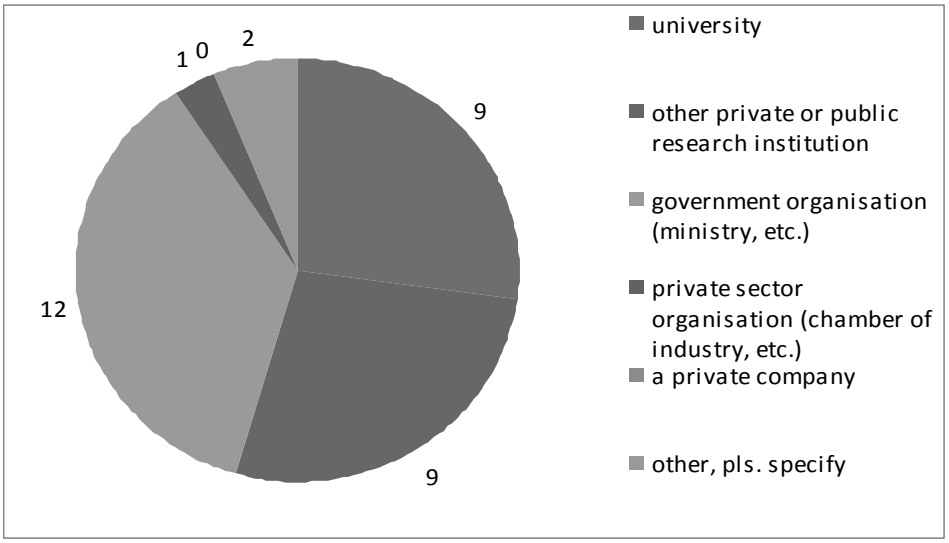

***Masters degree level is the most frequent under ICS fellows (35%), followed by PhD (25%). The share of PhD is significantly higher than in the 2008 sample described in ICS reports. However, it is still low enough to confirm the relation between a moderate share of PhD level fellows and a limited high level scientific output of the ICS.***

## 5 Where did you work before your fellowship?




***The distribution of sending institutions and institutions where people worked before, not surprisingly, is almost identical.***

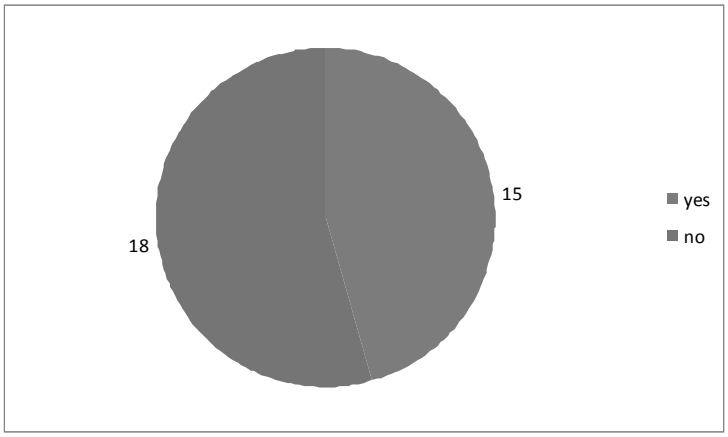
## 6 Are you currently working in




***The before and after patterns of ICS fellows work environment are highly similar. There is a slight move towards work in Government institutions after the ICS fellowships. But given the small sample and limited magnitude of this shift this is hardly representative.***

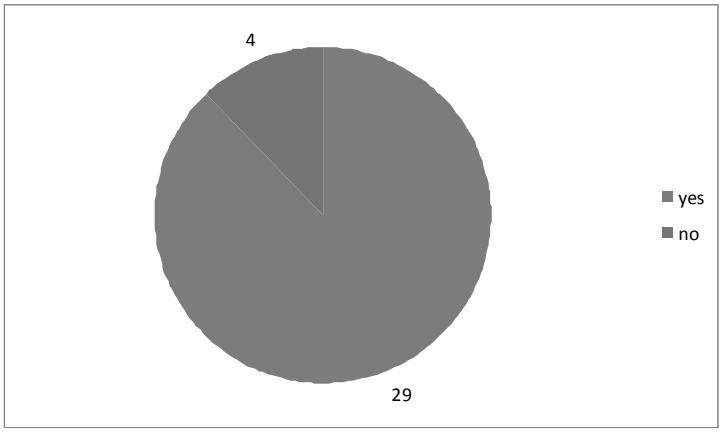
***All fellows from NCPCs returned to their NCPCs after the fellowship.***

**7 Did contacts made during your fellowship play a role in obtaining your present position?**



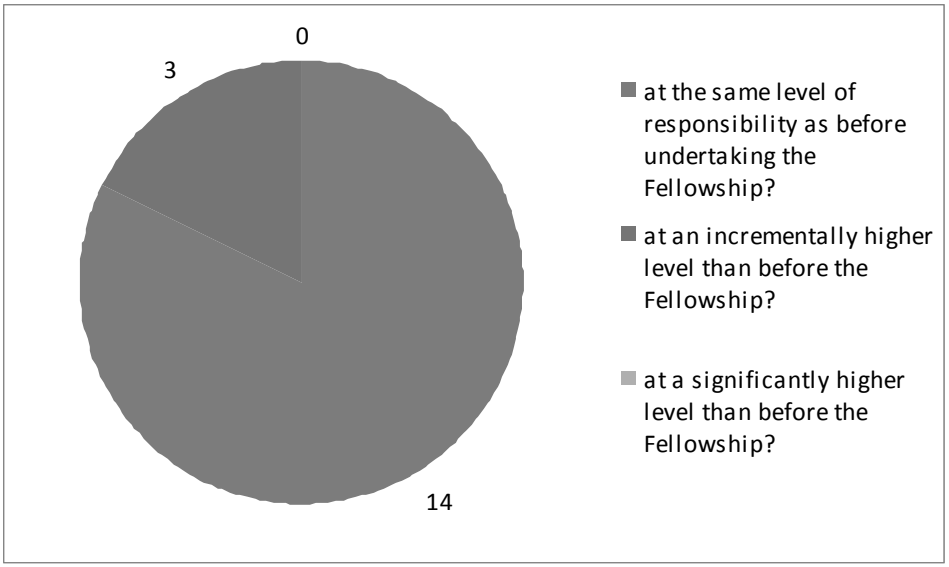

***For approximately half of the ICS fellows the fellowship played a role in obtaining their present position.***

**8 Is your current employment directly related to the research subject(s) pursued during your fellowship?**



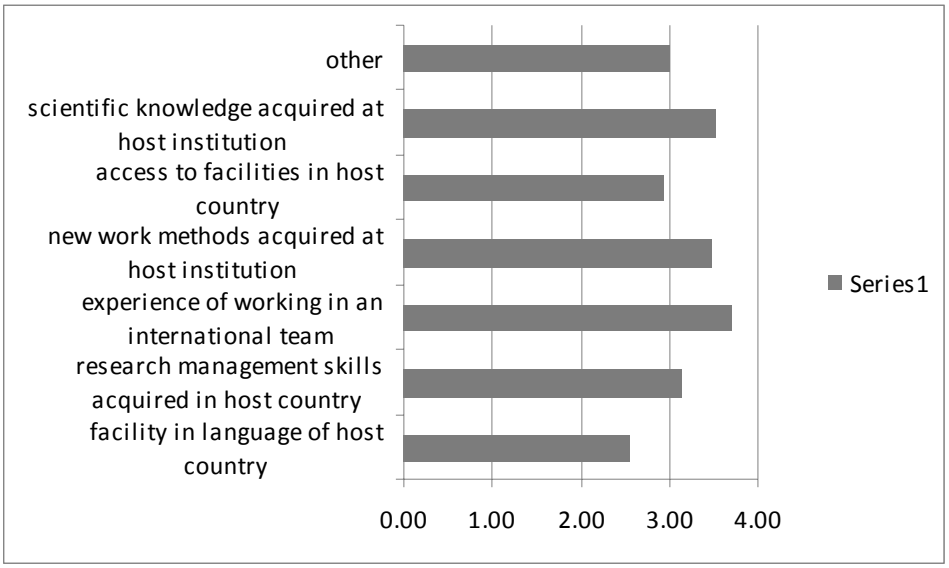

***There is a surprisingly high relevance of the ICS fellowships for the present work of fellows. This coincides with the responses from interviews with ICS fellows in Trieste, where most of them had concrete plans of how to apply the new knowledge in their home countries.***

## 9 Is your present employment




***The fellowship did not play an important role in the promotion of the fellows.***

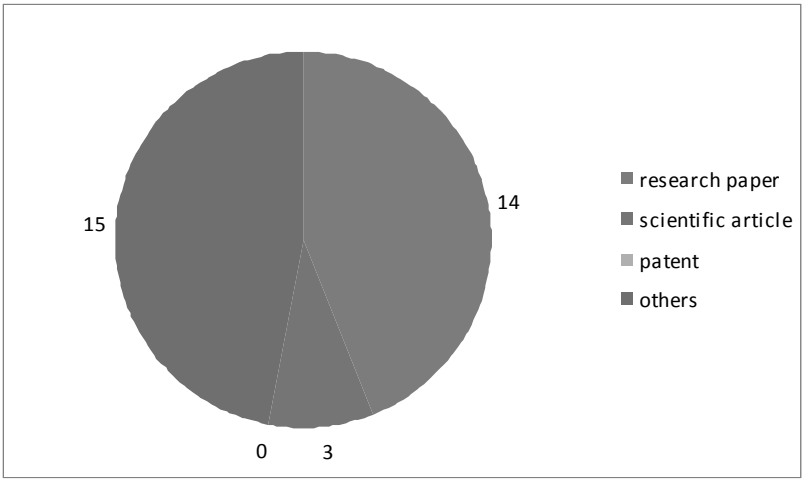
## 10 Which aspects of the fellowship programme were helpful in obtaining or advancing your present position? Please rate on a scale between 1 and 4.




***The most important aspects of the fellowship from fellows'point of view are the experience to work in an international team and the***

*scientific knowledge acquired. Knowledge factors and skills/experience factors are balanced in importance.*

**11 What was the scientific output of your fellowship?**




*Half of the fellows have produced a research paper or scientific article. Many of those who have not done so are still planning to produce a paper. There were no patents.*

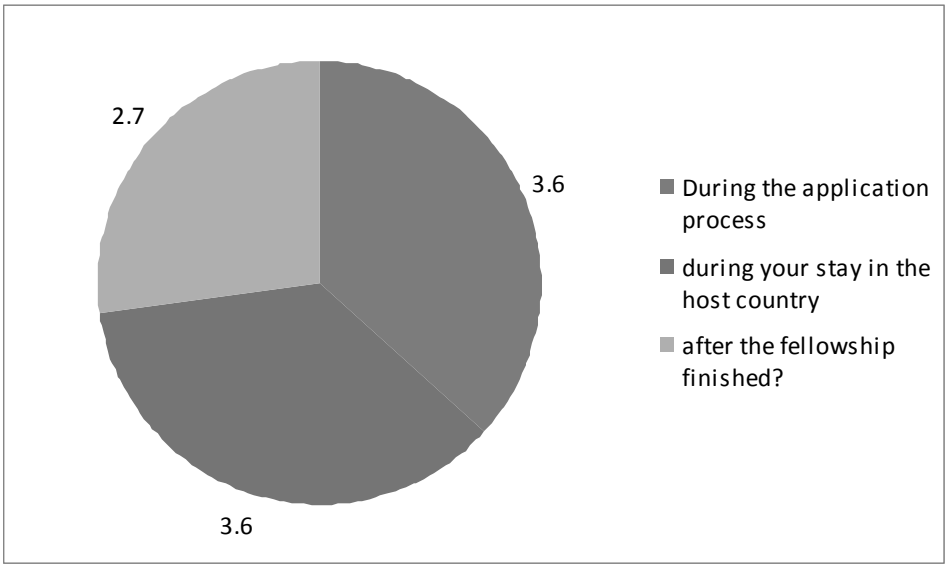
**12 Has that scientific output been refereed in any journal? Please provide scientific field, name of journal and publication date.**

*Only 3 of the fellows report publication of their work in a peer reviewed journal.*

**13 Did the fellowship provide you with the know-how that you expected?**

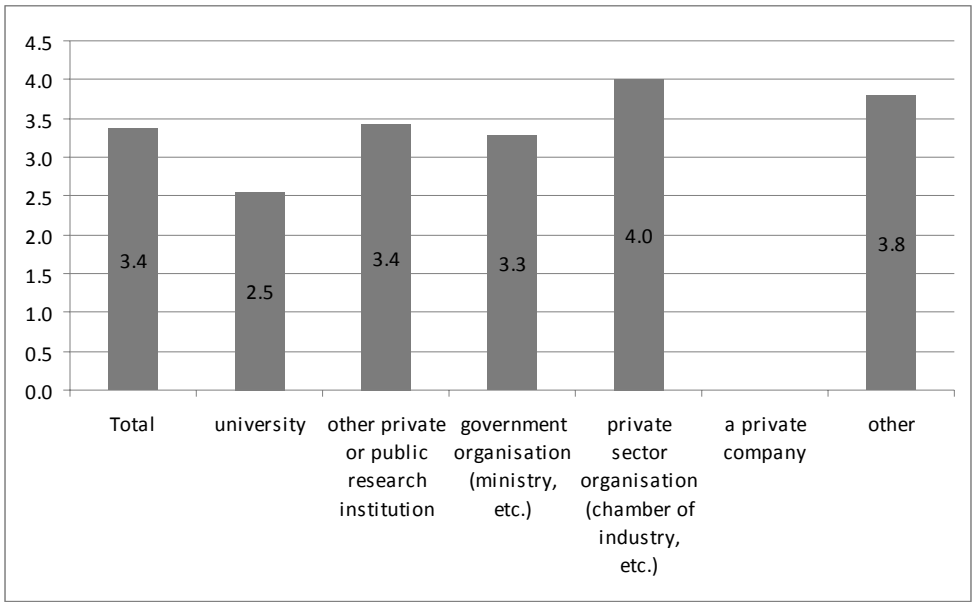
*The overall rating on a scale from 1 to 4 is 3.4. This clearly indicates a very high level of expectations met.*

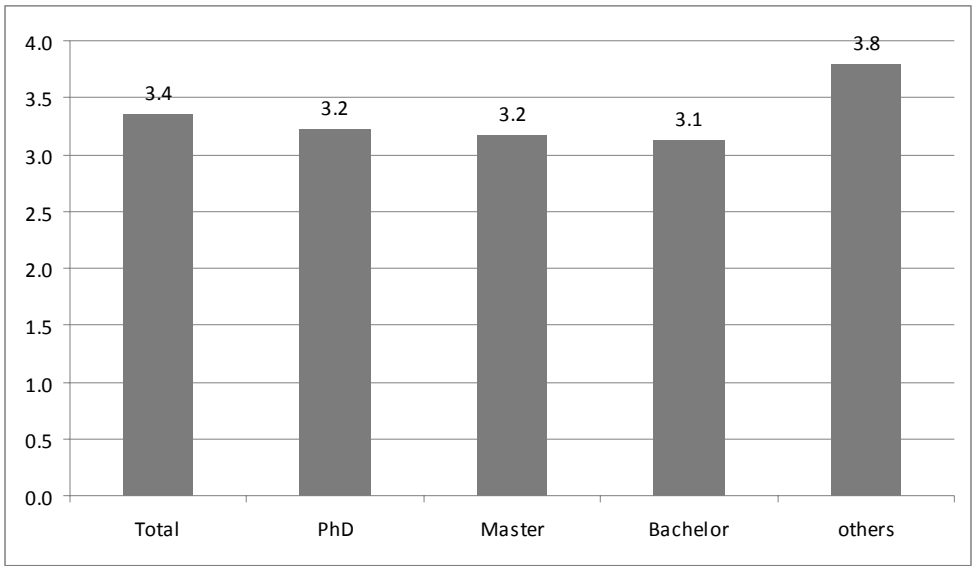
**14 How would you describe the administrative support by the ICS? Please rate on a scale between 1 and 4.**




***Overall the rating of the administrative support during the application process and during the fellowship is very high, indicating a vey high level of satisfaction and good support. After the fellowship this satisfaction is reduced, but still on the positive side.***
***There are no significant differences of these ratings among the different groups of fellows with regard to their institutional linkage (university, government, private).***

**15 How would you describe the scientific support provided by ICS during your fellowship on a scale between 1 and 4?**



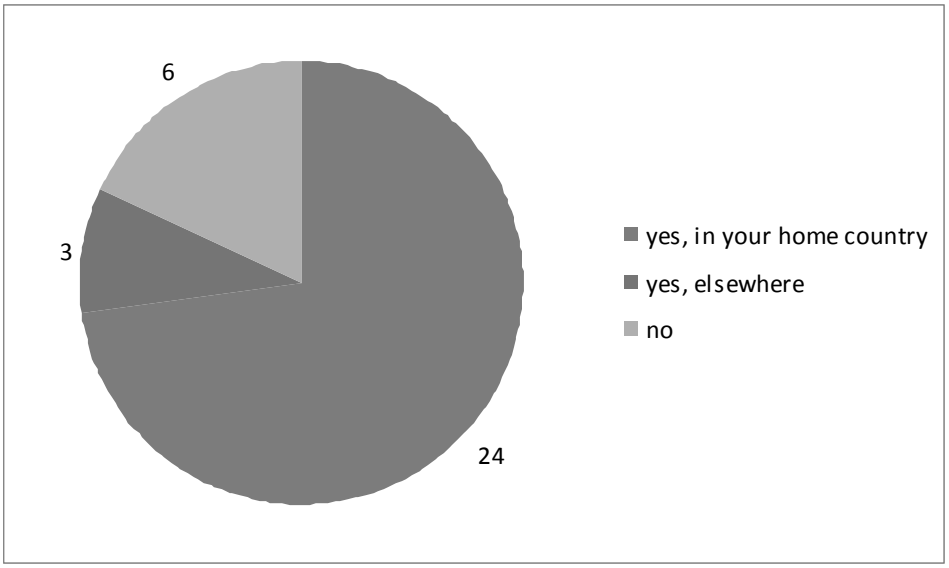




***Also the scientific support of the ICS receives a very high rating. While recognizing the small sample, it appears that the fellows coming from universities rate the scientific support significantly lower than the other groups. However, there is no difference in rating between those with a PhD compared to other degree holders.***

## 16 Was the fellowship of a suitable duration?

***The overall ratings (3.1 on a scale 1 to 4, 4 indicating much too short) indicate that fellowships are considered to be too short by all groups of fellows.***

## 17 Have you continued to work on the research subject of your fellowship?

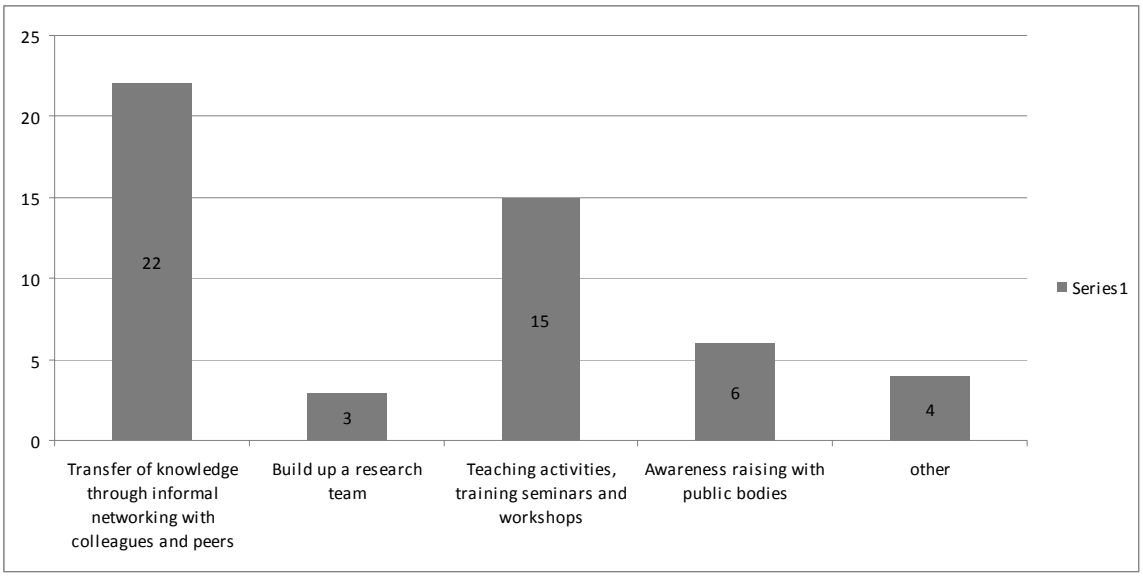



***73% of fellows continue working on their research subject in their respective home countries. This indicates a very high effectiveness at outcome level of the ICS fellowship programme (but it does not yet inform about impact).***

## 18 Have you tried to actively promote the results of your research in your home country?

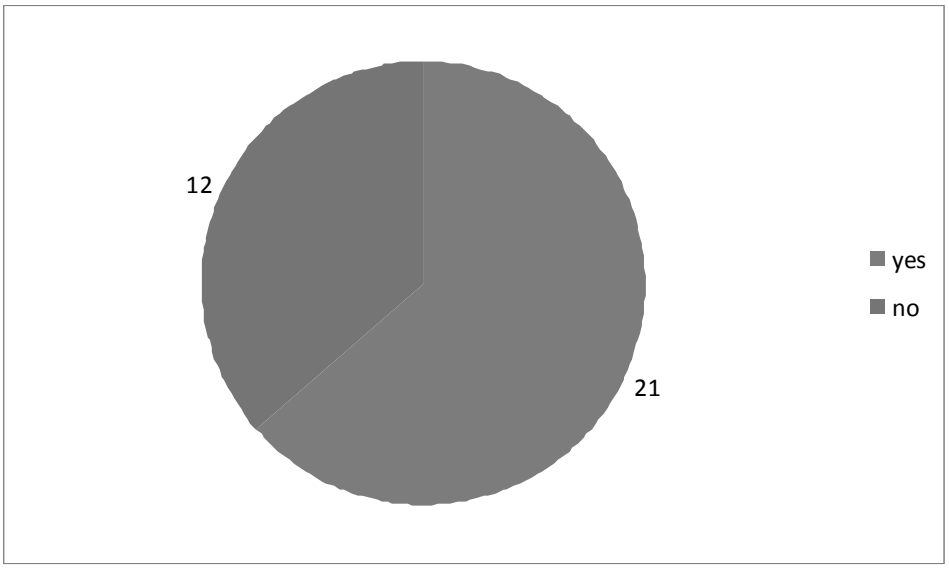
***94% of fellows claim that they have actively promoted their research topic in home country.***

## 19 If yes, in what way?




***The promotion of the research subject in the home country was mainly done through informal networking with colleagues and peers, followed by teaching and trainings. The Build up of research teams happened only in three cases, but interestingly there was no bias towards university (one case a university, one case a private sector institution, one case a NCPC).***

**20 Has there been any significant research or educational impacts for your own country resulting from your fellowship?**



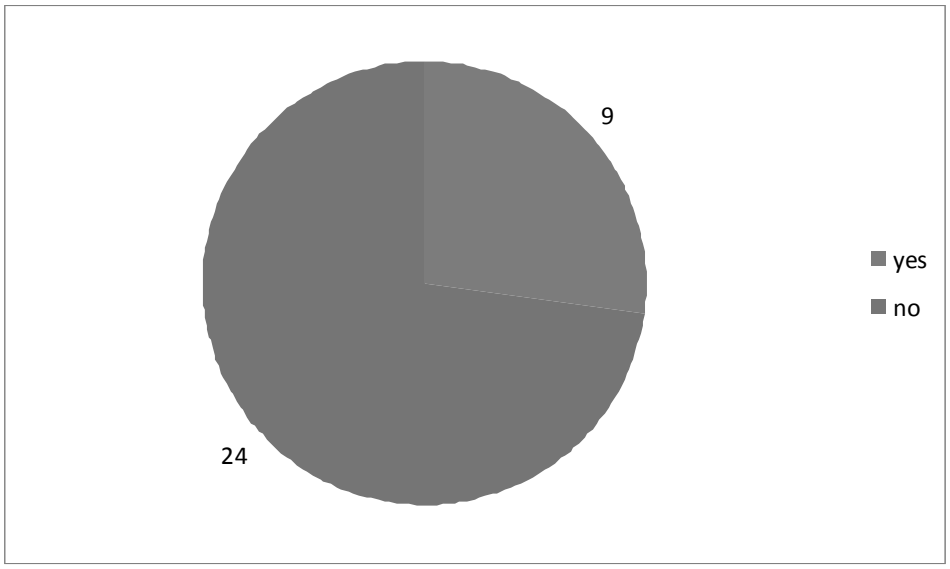

***The majority of fellows (64%) feels that their fellowship has or will have an impact in their home country.***

**21 If yes, what kind of impact? Please rate on a scale between 1 and 4.**

| | |
|---|---|
| Research-capacity building in home country | 2.5 |
| Greater awareness for the topic | 3.3 |
| Incorporation into educational or research-capability building initiatives | 2.8 |
| other | 4.0 |

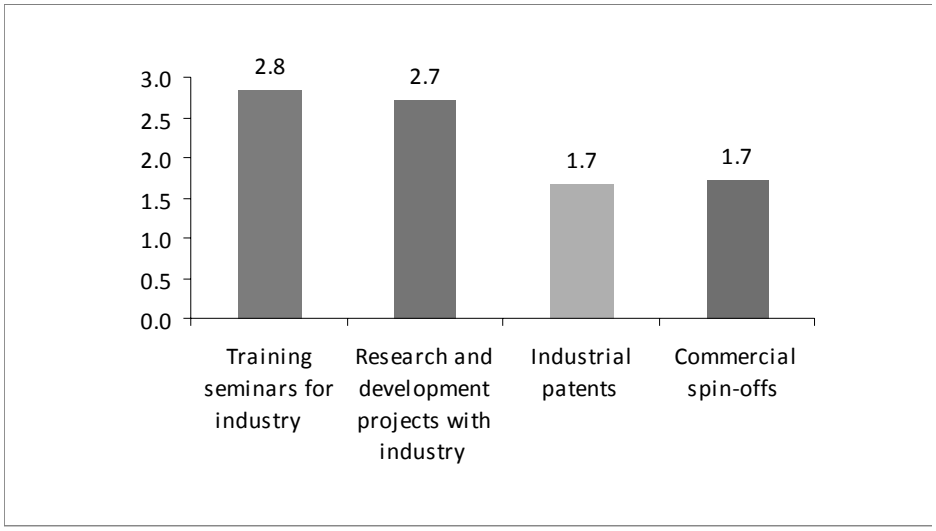
***The highest rating for impact is for greater awareness followed by incorporation of research findings in educational and capacity building initiatives. Research capacity building is rated with 2.5, still on the positive side but less important than the others. The outlier "other" is based on 2 respones which refer to human resource formation and e-learning.***

**22 Has there been any significant commercial/industrial impact for your own country resulting from your fellowship?**




***73% of fellows do not report any significant commercial or industrial impact. This confirms information collected through interviews and is supported by the fact that the ICS does not have a strong relation to the private sector.***

**23 If yes, what kind of impact? Please rate on a scale between 1 and 4.**



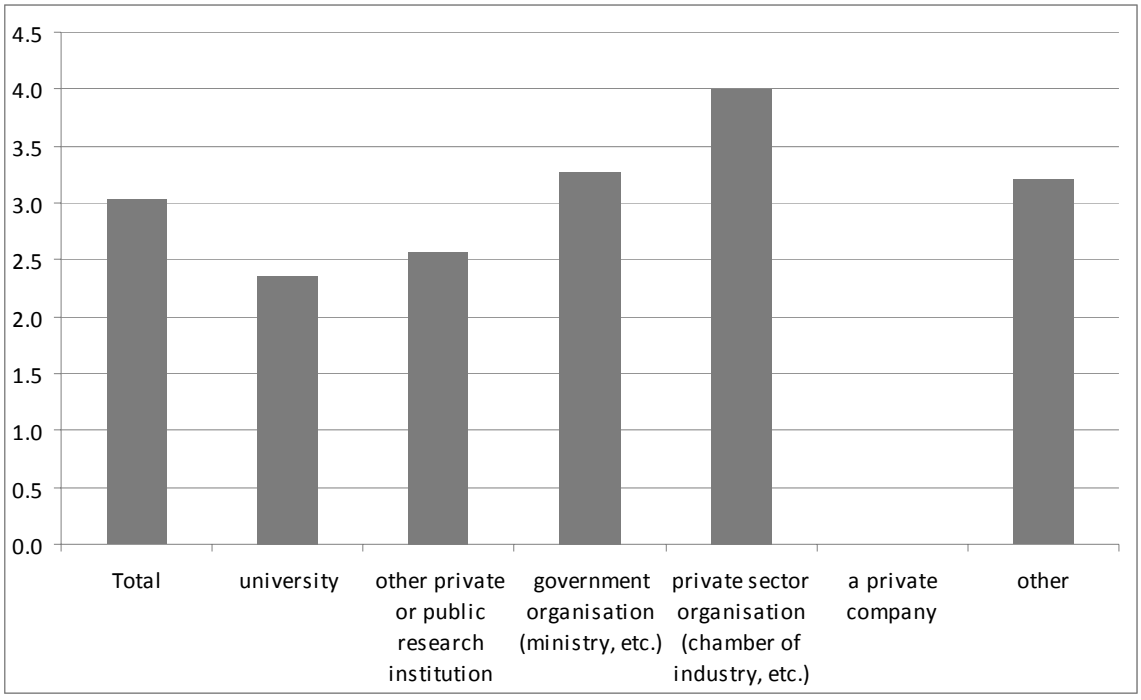

***For the 9 cases where some degree of commercial/industrial impact is reported, the most important ratings are on training and research***

*projects. Patents and commercial spin offs are relatively less important.*

## 24 Is the ICS an institution that responds to developing country needs?

*Overall rating 3.3 on a scale 1 to 4 indicates that a majority of fellows feel that ICS is well aligned with needs of developing countries. This is important as the fellows can be considered the most important linkage of the ICS with the developing world.*

## 25 Is the ICS partnering to a sufficient extent with scientific institutions?




*Overall rating 3.0 on a scale 1 to 4 indicates that a majority of fellows feel that ICS is sufficiently partnering with scientific institutions. However, fellows from universities think that there could be more intense partnering.*

## 26 Is the Trieste area a good scientific environment for fellows?

*3.7 overall rating confirms the good quality of the scientific environment in Trieste.*

**27 Do you have any recommendations on how the ICS fellowship programme could be improved?**

***Repeated recommendations:***

- ***Build longer term partnerships with institutions fellows come from***
- ***Extend the duration of fellowships to one year***
- ***Fellowship should culminate with a certificate or degree, avoid bringing fellows "half way" and then there are no resources to finish***
- ***More hands on exercises, including plant visits, should be included in fellowships***

***Some interesting recommendations (but came only once):***

- ***Increase accountability of fellows***
- ***Improve access to scientific papers.***

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