Thematic Evaluation of UNIDO's International Technology Centres

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Thematic Evaluation

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Abbreviations and acronyms

APCTT	Asia and Pacific Centre for Transfer of Technology
CTA	Chief technical advisor
FDI	Foreign direct investment
HACCP	Standards of hygiene applied in manufacturing
ICAMT	International Centre for the Advancement of Manufacturing Technology
ICGEB	International Centre for Genetic Engineering and Biotechnology
ICHET	International Centre for Hydrogen Energy Technology
ICM	International Centre for Materials Technology
IC-NHP	International Network for Small Hydro Power
ICS	International Centre for Science and High Technology
IC-SHP	International Centre for Small Hydro Power
ILO	International Labour Organisation
IP	Integrated Programme
IRENA	International Renewable Energy Agency
ISEC	International Centre for Promotion and Transfer of Solar Energy
ITC	International Technology Centre
ODA	Official Development Assistance
SITPC	UNIDO-Shanghai International IT Technology Promotion Centre
UN	United Nations
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization

Glossary of evaluation-related terms

Term	Definition
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. 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

Technology promotion is one of the priority areas within UNIDO's corporate strategy. The Medium Term Programme Framework (MTPF) 2006-2009 and the MTFP 2008-2011 include specific references to ITC support. According to the latter, "UNIDO will promote the diffusion of modern and relevant technologies for poverty reduction; particularly through its technology centre network".

Throughout the past biennium a number of evaluations were carried out of UNIDO International Technology Centres. These evaluations raised a number of issues that were felt to be of wider relevance, beyond the individual centres and their performance. This independent thematic evaluation aims at answering a number of key questions regarding UNIDO's support to international technology centres (ITCs). It is expected to contribute to the decision making in relation to UNIDO's future support to technology promotion in general and technology centres in particular.

The methodology included a review of documents and UNIDO staff interviews, a comparative review of UNIDO evaluation reports of individual ITCs, a self-assessment survey of ITCs, the re-construction of the UNIDO ITC programme theory and a review of current trends and practices in developing and developed countries regarding the role of international and national institutions in the promotion of technology. The evaluation was conducted by Johannes Dobinger, UNIDO Evaluation Group, (Team Leader), Ms. Lynn Mytelka, External Expert (context analysis and case studies) and Ms. Sophie Zimm (comparative review and self assessment).

Main findings and conclusions

Case studies of international centres and networks as well as the experience of some UNIDO ITCs like ICS Trieste and ICHET show that ITCs in principle have a good potential to enhance UNIDO's role in international technology promotion and maybe even to become a source of sector-specific competence for UNIDO.

Several ITCs (ICM, SITPC) are inextricably linked with and entirely dependent on counterparts with regard to staff resources. For these ITCs it is very difficult for UNIDO to exercise control over management. Therefore it is very problematic to consider these centres "UNIDO ITCs". The UNIDO sphere of control covers only the relatively small project budget, which represents only a small fraction of the centres budgets. Maintaining such centres as "UNIDO ITCs" can involve serious risks to the organization.

Other ITCs are more closely linked to UNIDO in administrative/institutional terms (e.g. ICAMT, ICS). However, these ITCs often show a very weak thematic linkage to UNIDO as there is no substantive UNIDO programme utilizing the Centre for its technical cooperation.

Conclusions regarding the design, intervention logic and the underlying theory of change:

Currently, the institutional characteristics, organizational structures and practices of UNIDO's ITCs often do not meet the requirements for innovation and knowledge-based competitiveness. One of the major shortcomings in ITC design is that issues of long-term institutional perspective, legal entity and UNIDO exit strategies are not properly addressed. It will be necessary to re-conceptualize the ITC program as a whole, and not merely to restructure selected ITCs.

The UNIDO ITCs cannot be considered a homogenous group of institutions. The centres themselves, the nature of support provided to them by UNIDO and the expectations regarding the ITCs' core functions vary widely. There is a remarkable absence of a common UNIDO approach to ITCs. However, there are two distinct groups of ITCs – those that are under UNIDO control and those that are under host/counterpart control.

UNIDO ITCs are relevant to developing countries in terms of their sectoral focus and overall objectives. However, many of the ITCs do not really cater to the needs of developing countries in their daily work. Some focus too much on their host countries or on promoting technology from their host country.

In this context, a remarkable absence of representatives from beneficiary countries in the ownership structures distinguishes UNIDO ITCs from many other international institutions (e.g. APCTT, ICGEB, IRENA) who do involve beneficiary countries much more actively in their decision making.

How does the ITC concept fit into the overall technical cooperation framework of UNIDO?

Tomorrow's industrial processes will need to be knowledge-based, resource efficient, resilient and sustainable. Strengthening the innovation capacity of industry is essential in meeting these objectives. While UNIDO's original mandate to support and promote industrial development of developing countries and countries with economies in transition continues to be valid, the ways in which this will need to be done have changed considerably since this goal was first articulated. ITCs and their potential to promote innovation-based competitiveness (see, for example, evaluation reports of ICS and ICHET) in developing countries fit very well into UNIDO's cooperation framework.

However, the absence of clear focus of the ITC approach on a limited set of core functions (e.g. strengthening the science-industry linkages or support of business R&D) represents a barrier to an effective linkage of ITCs to UNIDO technical cooperation as the role of ITCs and what is expected from them vis-à-vis UNIDO remains unclear and is subject to many different interpretations. Also the lack of results-orientation of UNIDO support to ITCs weakens this linkage.

The limited involvement in and control over some of the ITCs also implies considerable risks for UNIDO as these centres keep being part of the supposed "UNIDO Network of ITCs", using the UNIDO name to justify

activities that might or might not be compatible with the organisation's mandate, rules and regulations.

Nevertheless, UNIDO technical branches and the ITPO network could benefit from the technology related competence of ITCs if close co-operation and alignment of ITCs with UNIDO TC can be achieved. Good examples are chemical research of ICS and UNIDO's POPs programme, ICHET projects for renewable energy in the Pacific and the ICSHP's recent sub-contract for small hydro power projects in Zambia.

But at present the linkages to UNIDO are in many cases very weak. First, for many ITCs there is a lack of clear thematic linkage to UNIDO substantive programmes. Second, there are no clear rules that guide the work of ITCs to ensure their alignment with UNIDO objectives, principles and values.

Conclusions regarding the implementation and results of ITC related interventions

Three key issues represent a limit to ITC effectiveness.

First, some ITCs do not have sufficient outreach to developing countries as they focus their activities too much on their host countries (e.g. ICHET, ICAMT).

Second, so far the ITCs have not been effective in improving developing countries' competitiveness through more technology-based products nor have national innovation systems been strengthened. This is because in many cases the linkages between ITCs and industry or industry-support institutions are weak. Often the final target group - developing countries' industries - are not reached as trainings are geared towards the academic and public sectors (e.g. ICS). On the other hand, there are some positive cases (e.g. the direct linkages with industry of ICAMT, the involvement of industry in technology demonstration at ICHET) where target groups have been reached effectively.

Third, the capacity building dimension has been clearly identified as a weakness of most of the ITCs as many of them focus on awareness raising, training of individuals and promotion of host-country technologies. However, also here positive examples exist. For example, the Delhi 3-wheeler project of ICHET has involved local institutions and companies, combining locally available technology with state-of-the-art hydrogen technology with likely lasting capacity building effects on local technology development.

The effectiveness of UNIDO support to build up the ITC's own capacities has been found to be rather limited in most of the cases. As a result of this, there is a particular weakness when it comes to reporting outcomes, i.e. development effects of technology-related initiatives. Practically none of the ITCs provides reports beyond the activity level.

UNIDO has not yet answered the questions a) what constitutes a UNIDO international technology centre and b) when is there a need for an international institution to be supported or created.

Recommendations

The following recommendations can be grouped into two major areas of action for UNIDO:

1) To improve existing cooperation with ITCs
2) to exploit the future potential of ITCs to enhance UNIDO's contribution to technology-based industrial development

1) To *improve existing cooperation with ITCs*

Clearly define different types of UNIDO support to ITCs

For future ITC support UNIDO should establish a clear distinction between a) setting up a new UNIDO ITC, b) establishing partnerships with an existing ITC ("UNIDO Partner ITC") and c) providing assistance to an existing institution in its efforts to internationalize.

Clearly define the institutional and thematic relationship between ITCs and UNIDO

ITCs should only be considered **"UNIDO ITCs"** if they are controlled and managed by UNIDO and a strong thematic relationship exists with existing UNIDO programmes. Currently only the ICS and ICHET can be considered to fall in this category as almost 100% of their funds are channelled through UNIDO and they also posses in-house technology capacity and competence in areas relevant to UNIDO. However, the effective control and management applied in both of theses ITCs requires additional UNIDO attention (see respective evaluation reports).

The ITCs that are controlled and managed primarily by their host institutions but maintain mutually beneficial relationships with UNIDO – including a clear thematic linkage to UNIDO's substantive programmes - should be considered **"UNIDO Partner ITCs"**. The only ITCs that currently show a potential to develop within the short term into such Partner ITCs are ICSHP and ISEC.

For Partner ITCs a standard partnership agreement should be developed that:

- is mutually binding
- defines the roles and responsibilities of UNIDO, the ITC host and counterparts
- establishes a "firewall" between the host and the ITC, including clear rules about the use of the UNIDO name and logo
- ensures that wherever the Partner ITC acts on UNIDO's behalf (e.g. through a subcontract) the objectives, principles and values of UNIDO are adhered to.
- rules out the use of the UNIDO name and logo for commercial purposes

- ensures that UNIDO ITCs and Partner ITCs acting on behalf of UNIDO have - besides their technological capacities - sufficient capacities in terms of development cooperation.

The ITCs whose funds are not controlled by UNIDO or who do not have a thematic linkage to UNIDO programmes and a mutually binding partnership agreement along the lines described above should be removed from the list of UNIDO ITCs. However, the relationship of those ITCs and UNIDO can continue through regular technical cooperation projects and/or participation in a UNIDO-managed network of technology centres (see Recommendations under 2).

Ensure quality of UNIDO support to ITCs

Existing UNIDO ITCs and partnerships should be maintained and new ones established only if the necessary capacity for technical backstopping, quality control and active participation in decision making is available at UNIDO HQ.

Within UNIDO an ITC focal point should be established that monitors the UNIDO relations to the different types of ITCs (see above) and ensures that minimum requirements are maintained and UNIDO rules are complied with.

Wherever possible, field offices should actively participate in the technical backstopping of UNIDO work with the ITCs.

Results based management, including adequate monitoring of results should replace the current practice of reporting on activities only. A future UNIDO strategy for ITCs should include guidance on how to formulate and measure results of technology promotion and innovation support.

2) *To exploit the future potential of ITCs to enhance UNIDO's contribution to technology-based industrial development*

Develop a coherent UNIDO strategy document

- As a basis for revisiting the existing network of ITCs and before establishing any new ITC, UNIDO should develop a comprehensive strategy document elaborating on the Organization's mandate and role in technology transfer and innovation and positioning ITCs as part of an overarching strategy.
- In line with current international theory and practice, "innovation" instead of "technology" should become the guiding principle of the new UNIDO strategy. Consequently, UNIDO should consider rebranding its "technology centers" into "innovation centers".
- The role of FDI and how the network of UNIDO ITPOs assists developing countries with using FDI strategically for innovation should be developed.
- The new strategy should benefit from the good practices that some of the ITCs have established (e.g. international call for proposals for technology demonstrations in ICHET, fellowship programme and e-learning in ICS).

Define the role(s) and functions of ITCs

As part of the overall strategy, the document should define: the ITC approach; the different types of ITCs and their corresponding functions; the rationale of how ITCs contribute to overall UNIDO programme objectives; the different types of linkages between ITCs and UNIDO and the different approaches of how UNIDO supports ITCs. Existing programme approaches such as the "Joint UNIDO-UNEP Programme on Resource Efficient and Cleaner Production (RECP) in Developing and Transition Countries" could serve as an example.

The future strategy should distinguish between different types of ITCs on the basis of a number of key characteristics such as:

- Core functions the following list of categories could be used by UNIDO for strategy planning: Research, Technology development & diffusion, linkages & networking, training & researchers' mobility.
- Core instruments used: fellowships, short-term trainings, demonstration projects, applied research, awards & grants, etc.
- Ownership: UNIDO owned, host country owned, multi (beneficiary) country owned
- Type of linkage to UNIDO: direct linkage to TC sectoral programmes (e.g. POPs research, energy efficiency technology development, etc.); direct linkages to horizontal programmes (e.g. south-south cooperation); in-direct linkage through membersip of network of ITCs (projects that support "non-UNIDO ITCs").

Benchmark UNIDO ITCs to similar institutions

Based on the review of comparison cases (see Annex) a number of benchmarks could be defined for setting up and maintaining ITCs:

- a well defined process for setting up centres is important and, although centres may wish to report to host governments, a clear reporting line of the centres to the parent agency is of essence.
- From an innovation systems perspective, programmes should expand in ways that strengthen the system as well as the actors within it.
- international centres should benefit from international ownership
- centres should have directors selected through international competition.

Explore a networking approach

UNIDO should consider strengthening the creation of international networks of technology related institutions in developing countries. In this regard, lessons learned should be analysed from the EU Enterprise Europe Network and from the NCPC network, which constitutes a network of national institutions directly linked with industry and benefitting from UNIDO's support and international networking.

Lessons learned

The case of UNIDO ITCs demonstrates that without strategic and programmatic guidance a supposed “UNIDO approach” - in this case the ITC approach – produces projects that have weak institutional and thematic linkages with UNIDO. This weakens the potential contributions of such projects and centres to the overall objectives and outcomes of UNIDO.

Centres are usually institutions designed to function for a longer-term, indefinite period, which makes them different from short- to medium term TC projects. The experience of some ITCs has shown that the instruments used by UNIDO for design and management of technical cooperation projects are of limited relevance for what is needed to manage UNIDO’s involvement in centres. If UNIDO continues supporting institutions over longer periods, specific instruments and tools need to be designed in order to ensure effectiveness, sustainability and to minimize risks.

I

Introduction

A. Background

UNIDO maintains a network of international technology centres (ITCs). Throughout the past biennium, the UNIDO Evaluation Group (ODG/EVA) carried out a number of evaluations of UNIDO International Technology Centres. These evaluations raised a number of issues of wider relevance, beyond the individual centres and their performance.

B. Purpose and methodology of this evaluation

This independent evaluation was conducted by ODG/EVA in accordance with the UNIDO Evaluation Policy. It aimed to answer a number of key questions regarding UNIDO contributions to technology promotion in general and its support to international technology centres (ITCs) in particular. Hence, the purpose of the evaluation was threefold:

- Contribute to organizational learning by assessing the continued relevance and by identifying strengths and weaknesses of UNIDO technology centre initiatives with a view to enhance performance of projects and upstream activities.
- Contribute to accountability by assessing the achievements of UNIDO's support to ITCs.
- Contribute to the decision making in relation to UNIDO's future support to technology promotion in general and technology centres in particular.

The evaluation covers individual centres as well as up-stream and Global Forum activities (if any) and the network of ITCs, including the degree of cooperation among the ITCs and with other UNIDO projects, centres and offices.

Methodology and scope

The review consisted of five main components:

1) Review of documents and UNIDO staff interviews

2) Comparative review of UNIDO evaluation reports, in particular those of individual ITCs[1]

3) Survey and self-assessment of ITCs

4) Re-construction of the UNIDO ITC programme theory

5) A review of current trends and practices in developing and developed countries regarding the role of international and national institutions in the promotion of technology.

Evaluation team and timing

Ms. Lynn Mytelka, External Expert, context analysis

Mr. Johannes Dobinger, UNIDO Evaluation Group, Team Leader

Ms. Sophie Zimm, External Expert, Research

The evaluation was carried out during one year from March 2010 (circulation of TOR) to March 2011. Presentations and discussions of preliminary findings were organized in May and September 2010.

Limitations of this evaluation

It was not possible to obtain information for all ITCs. Ten ITCs were invited to participate in the self assessment survey. Only seven of them participated, despite repeated reminders.

- Reporting from the ITCs to UNIDO is in many cases very limited and does not allow an in-depth analysis of the activities and results.
- Not all evaluation reports provided the same set of information, hence not all aspects of ITCs were compared across reports.
- There is no common strategy or intervention logic of ITCs, although technology promotion is frequently presented in UNIDO documents as a commonality. Therefore the evaluation team re-constructed a generic intervention logic for ITCs, based on different statements regarding the expected results of ITCs and taking into account the observed ITC activities and outputs.

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[1] Recently the following ITCs have been subject to independent evaluations:
- ICS – International Centre for Science and High Technology (Italy)
- ICHET – International Centre for Hydrogen Energy Technology (Turkey)
- ICM – International Centre for Materials Technology Promotion (China)
- SITPC - UNIDO-Shanghai International IT Promotion Centre (China)
- ICAMT – International Centre for Advancement of Manufacturing Technology (India)
- the evaluations of Integrated Programmes (IPs) or Country Service Frameworks (CSFs) in countries where ITCs have been set up.

C. Evaluation subject – UNIDO International Technology Centres

UNIDO's Constitution mandates the organization to "promote, encourage and assist in the development, selection, 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" and to "assist in the establishment and operation of institutional infrastructure for the provision of regulatory, advisory and developmental services to industry".[2]

Thus, "transfer of technology" is at the core of the UNIDO mandate but the evaluation did not find evidence of a fully developed strategy or programme that describes the role of the ITCs and a common theory of change.

However, references to ITCs can be found in several UNIDO strategy documents. A UNIDO publication of 2001[3] describes the ITCs as a central element of UNIDO's "technological infrastructure approach":

"Creation and upgrading of Technology Centres:
UNIDO has been active at creating international technology centres in various technical areas. The original purpose of the centres was to increase awareness of new technologies in the developing countries and to allow access to applied research and development and training in these new technologies for participants from developing countries.

Each Technology Centre has a network/sub networks consisting of industrial R&D institutes, universities, industrial associations and professional societies working in the same subject area and having their own networks of partners with strong links to industry. These networks surrounding the Centres provide the opportunity to ensure that the work programmes of Centres reflect continuously the industrial and market needs of beneficiary countries.

Information on expected UNIDO results can be found in the UNIDO Programme and Budget (P&B). The P&B for the period 2006/2007 includes a specific output: "established and strengthened international and national technology centres as well as technology parks". Related expected outcomes are: "Institutional capacity of national innovation system strengthened" and "International and national centres, ITPOs and related networks established and strengthened".

The P&B for the period 2008 to 2009 included the programme component "technology diffusion". But ITCs were not explicitly mentioned as planned outputs, target groups or counterparts. The P&B for the biennium 2010 to 2011 does not include a programme component "technology diffusion" anymore. The most relevant component for ITCs in this document is "investment and technology promotion" but no explicit reference to ITCs can be found whereas several

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[2] UNIDO Constitution, 1979
[3] Technological Infrastructure, UNIDO's Approach, June 2001

technology transfer functions are planned to be carried out by UNIDO's Investment and Technology Promotion Offices (ITPOs).

In addition to the programmatic documents, certain project documents mention the existence of an ITC network, such as the one for the International Centre for the Advancement of Manufacturing Technology (ICAMT)":

"One of the major initiatives of UNIDO in this area is to establish a technology promotion and transfer network consisting of International Technology Centres. These Centres are considered as a unique tool to promote international collaboration, transfer and diffuse technological knowledge and innovations and buildup technology partnerships thus bridging the technology divide. Each centre has a network consisting of government institutions, industrial associations, R&D institutions, universities, professional societies and funding agencies. Close links of ITCs and their networks with industry ensure that their work programmes continuously reflect the industrial needs of the country."

Apart from the above there is little information available on the UNIDO ITC approach and intervention logic and no programme document exists.

The following ongoing ITCs had been identified for inclusion in the evaluation exercise:

International Centre for Advancement of Manufacturing Technology (ICAMT, Bangalore, India)
UNIDO-Shanghai International IT Technology Promotion Centre, (SITPC, Shanghai, China).
International Centre for Materials Technology Promotion (ICM, Beijing, China).
International Centre for Science and High Technology (ICS, Trieste, Italy)
International Centre for Small Hydro Power (ICSHP, Huangzhou, China),
International Centre for Promotion and Transfer of Solar Energy (ISEC, Lanzhou, China)
International Centre of Hydrogen Energy Technology (ICHET, Istanbul, Turkey)
UNIDO-Shenzhen Environment Technology Promotion Centre (ITPC, Shenzhen, China).
International Materials Assessment and Application Centre (IMAAC, Brazil)
International Institute for Monitoring and Management of Environment, Resources and Resources' Recovery Technologies (UNIDO IMR, China)

II

The context of international technology centres

A. Introduction: Technology and innovation

In the following context analysis, technology and transfer of technology are understood as inseparably linked to the concept of innovation. Technologies are developed or transferred in order to induce change towards modernization, increased productivity and efficiency and to better meet existing and emerging needs of people and institutions. In other words, the usefulness of technology related projects, programmes and institutions can only be understood if it is clear how they are embedded in innovation processes.[4]

B. The role of innovation in competitiveness

The last decades of the 20th century were marked by changes in the global pattern of production and competition with important consequences for industrial competitiveness in both developed and developing countries. Production became increasingly more knowledge intensive as investment in intangibles such as research and development (R&D), software, design, engineering, training, marketing and management came to play a greater role in the production of goods and services (Mytelka: 1999). Gradually the knowledge-intensity of production extended beyond the high technology sectors to reshape a broad spectrum of traditional industries -from the shrimp and salmon fisheries in the Philippines, Norway and Chile, the flower enterprises in Kenya, the Netherlands and Colombia to the furniture, textile and clothing firms of Denmark, Italy, Thailand and the PR China (Mytelka & Farinelli:2003, Chandra:2006). Indeed, where linkages were established to a wider set of knowledge inputs and the local knowledge base was deepened; these traditional industries showed a remarkable robustness in the growth of output and exports throughout the 1980s & 1990s.

Within the context of more knowledge-intensive industries, firms began to compete not only on price but also on the basis of their ability to innovate. In information technology, generations of semiconductor chips or software

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[4] See, for example, World Bank Discussion Paper "Building Science, Technology and Innovation Partnerships for Building Capacity, STI Global Forum, 2009

succeed each other in less than 18 months[5]. In more traditional industries such as textiles and clothing, brand-names and design changes turned commodities into diversified goods (Mytelka:2004). Overtime, an innovation-based mode of competition became entrenched and rapidly diffused around the world through the process of trade liberalization and the deregulation of domestic markets.

Since the 1980s, the industrial countries have embraced the view that development, in an open world economy, requires a continuous process of innovation in order to face these new competitive challenges. This has now become mainstream thinking (OECD: 1992). The perception of developing countries as 'technology users' reliant on imports of technology from abroad, rather than as 'technology producers' and 'innovators' in their own right, however, has been slower to change. Although the rise of the East Asian Tigers called attention to technological mastery as an important element in the industrial development process, a debate persisted over whether 'imitation' was truly 'innovation' for many years thereafter (Amsden:1989, Kim:1997).

In the 1990s and into the new millennium pressure on developing country enterprises to become more innovative increased dramatically. In addition to the growing knowledge-intensity of production and the widespread diffusion of innovation based competition, developing countries faced the emergence of new technologies, competitors and competitive practices that challenged earlier opportunities to enter export markets from a low skill base and to subsequently pursue an incremental process of catching up (Pietrobelli & Rabellotti:2006). New rules at the international level (sanitary and phytosanitary standards, labour standards) as well as the need to meet climate change obligations by introducing new clean, renewable and efficient energy and water technologies, are adding to these pressures.

In this context, strengthening tertiary education and domestic research capacities has become essential in developed, emerging and developing countries[6]. Where this took place and a conscious effort by industry to learn and innovate was stimulated and supported by government policies, a number of developing countries, India, China, Brazil, Cuba and South Africa, for example, emerged as innovators, particularly in information and communications technologies, pharmaceuticals & biopharmaceuticals and energy-related industries. Even then, the bulk of the least developed and developing countries remained cast in the earlier mode.

The complexity of knowledge in the industrial sector and the range of inputs from other knowledge bases in both new and traditional industries creates still other obstacles for the large number of small and medium sized enterprises that are the backbone of the industrial structure in most developing countries. The ability to access a wide knowledge base, to network and to manage a portfolio of partnerships is essential in today's

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[5] Cell phones, software, diagnostics and drugs have registered similar generational changes.
[6] The concept 'developing' countries includes the least developed countries whose exports of manufactured goods face similar competitive conditions.

competitive world. Simply co-locating universities and enterprises, however, does not necessarily lead to the interactions, knowledge and information flows that sustain innovation processes overtime. Measures to strengthen the broader system of innovation will also be needed.

New knowledge, new combinations of knowledge and the capacity to use that knowledge in production, or what is more generally known as 'innovation' are the building blocks of today's competitive advantages. This is where the role of international institutions in the promotion of research with a view to enhancing the competitiveness and innovation capacities of industry in developing countries, now finds its greatest importance.

C. Strengthening innovation capacity in developing country industry

Innovation is a process of learning, adaptation and change in technology, organizational structures and institutional practices in which the application of knowledge plays a central role. In industry, especially in developing countries, it consists of the process by which firms create and use knowledge to master and implement the design, development and production of goods and services that are new to them – irrespective of whether they are new to their competitors, their countries or the world (Ernst et.al:1998). Access to knowledge and information, the capacity to reverse-engineer existing products, to absorb and adapt imported technologies, transfer knowledge from universities and research institutes to producers or end users and networking to solve technological problems are all parts of an innovation process.

C.1 Research, technology and innovation

Much of the earlier literature on growth and development, however, confused the process of innovation with either research, as in the practice of recording levels of expenditure on research, numbers of scientists and engineers, patents, and publications, or 'technology' as inventoried by the quantities and costs of new machinery and equipment purchases, most often imported in developing countries. Whether patents were taken up in production or scientists and engineers were involved in sales rather than in absorbing the knowledge embodied in machinery and equipment and using it to modify the old or design new technology, production processes and products, were rarely considered.

From a learning and innovation perspective, however, it is important to recognize that neither research nor science and technology are themselves, innovation. Nor does the funding of research automatically lead to its uptake by potential users, be they industrial firms, the health or other sectors. This becomes apparent in the relatively small number of patents that are taken up in production. It is also reflected in the question often asked in connection with energy efficient technologies, 'if such technologies exist

why are they not used?'[7] While research may contribute to innovation, the process from 'knowledge production' to innovation is neither linear nor is it automatic. Policies, habits and practices and other factors affect the choices that move new knowledge to markets as Kline & Rosenberg (1986) illustrated in their 'chain-linked model'.

Similarly, although Foreign Direct Investment (FDI) has traditionally been regarded as an important means of securing capital for investment in the purchase of new machinery and equipment, generating employment and in more recent times fostering exports (Lall: 2002, 52), simply attracting a Multinational Corporation to locate within a particular country does not lead to an automatic flow of knowledge or to learning and innovation. MNC affiliates are, after all, parts of a very different network and their behaviour is shaped by other institutional referents and strategies. The overall benefits of FDI thus critically depends upon host-country policies (OECD: 2002, 9).

Innovative policymaking, for example, can play a role in reshaping the parameters within which the decisions of foreign affiliates are made, thus creating opportunities for knowledge spillovers. It can also strengthen absorptive capacity through investment in tertiary education and research. In a developing country context, therefore, the ability of governments to situate FDI within the context of the country's development goals, target the right Multinational Corporations (MNCs) and stimulate a process of learning and innovation are thus essential.

C.2 *Strengthening innovation systems*

Increasingly, the literature on learning, innovation and competitiveness has focused on the longer term process of strengthening, what have come to be called, 'innovation systems' - whether at the national, regional or sector levels. Underlying the system of innovation approach is an understanding of innovation as an interactive process in which enterprises in interaction with each other and supported by institutions and a wide range of organizations play a key role in bringing new products, new processes and new forms of organization into economic use (Nelson: 1993; Nelson and Winter: 1982, Lundvall, 1992).

Conceptually, the innovation system approach acknowledges the role of policies, whether tacit or explicit, in setting the parameters within which these actors make decisions about learning and innovation and it distinguishes 'organizations' such as universities, public sector research bodies, science councils and firms from 'institutions'. The latter are understood as "sets of common habits, routines, established practices, rules or laws". These regulate the relations and interactions between individuals and groups (Edquist: 1997, 7). "Habits, practices and routines…prescribe behavioral roles, constrain activity and shape expectations" (Storper: 1998,24) that, in turn, affect the innovation process. Thus, in contrast to neo-classical theory which "sees economic actors as facing a spacious

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[7] This is a central question in the forthcoming UNIDO, Industrial Development Report, 2010/11.

choice set, including possible actions that they never have taken before, within which they can choose with confidence and competence…(innovation systems approaches) see economic actors as at any time bound by the limited range of routines they have mastered. Each of these has only a small range of choice. Further, the learning of new routines by actors is a time consuming, costly and risky thing" (Nelson & Nelson: 2002,269). These ideas have entered mainstream business and economic analysis of innovation and corporate 'culture' and are reflected in the problem of path dependence[8].

The utility of the distinction between organizations and institutions is threefold. First, it draws attention to the fact that simply identifying the existence of key actors co-located within a geographical space, does not predict to their interaction. Actor competences, habits and practices (and other institutions that reinforce these) with respect to three of the key elements that underlie an innovation process – linkages, investment and learning – are critical in determining the nature and extensiveness of their interactions (Mytelka: 2000).

Second, from a policy perspective, in terms of both policies designed to stimulate innovation and the measures to support innovation practices in industry, the distinction between organizations and institutions builds awareness of the need to look more carefully at the historical specificities of these habits, practices and institutions, their learned nature and the possibility that at least some of these will become less relevant as conditions change overtime. Continuous monitoring of policy dynamics generated by the interaction between policies and the varied habits and practices of actors in the system, will thus be of importance in fine-tuning policies and policy instruments for maximum impact. This has a bearing on the role assigned to international technology institutes and their need to evolve overtime. From a systems-of-innovation perspective, learning and unlearning is needed on the part of all actors – users, producers and policymakers – if the innovation system is to evolve in response to new challenges.

Third, it redirects attention towards the flows of knowledge and information that are at the heart of an innovation system. Although these may, on occasion, move along a linear path from the ‘supply’ of research to products in the market, more often they are multidirectional and link a wider set of actors than those located along the value chain. Which actors other than, suppliers and clients, will be critical to a given innovation process cannot always be known a priori and they are likely to be sector specific. So, while it is important to have an overview of the ‘national’ system of innovation, sector specificity –in industrial structure and technological terms-- and the particular habits and practices of actors in that sector will be major factors in shaping policy dynamics and policy impacts.

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[8] The concept of path dependence is reflected in, among others, engineering 'beliefs about what is feasible or at least worth attempting', boundaries that shape processes of choice such as lines of research to pursue, the kinds of products to produce, organizational routings and development trajectories' (Teece:1988,265-6)

D. Relevant policies, strategies and initiatives – case studies

Many national and international organizations have developed innovation policies and support measures. Although these have been organized and delivered in a variety of different ways, for the most part traditional approaches tend to treat support measures additively as opposed to interactively. From an innovation systems perspective, the latter is essential. In developing a matrix for the selection of case studies that map the roles that international organizations might play in the promotion of innovation capacities in industry, this section, therefore, draws upon the discussion of innovation and innovation systems in Section Three. It also takes into consideration the institutional characteristics and functions of UNIDO's International Technology Centers as reported in previous chapters, and the support measures developed by the European Union and governments in Brazil and South Africa.

D.1 Innovation support measures

The European Union (EU) has a long history in the development, application, assessment and modification of research and innovation policies and in the practical application of these in innovation support measures. Recently, with the aim of facilitating access to such information within and outside Europe, the European commission, created an inventory of research and innovation policy measures and their objectives.[9] Table 1, which contains the framework for this inventory and is used in the monitoring of research and innovation policy measures within the EU, provides a useful point of departure in characterizing the large number of innovation support measures that currently are being implemented at the national level.

As the Table below illustrates, the overall structure of this framework is oriented towards national policies as opposed to the international centers which are the focus of this review. While international technology centers do not make policy, a closer look at the headings in column one and the specific objectives of the measures in column two, show the utility of this framework in identifying the variety of organizational and institutional characteristics and functional aspects of support measures for industrial innovation that might be undertaken by international technology centers and against which we can chart the range of such activities in the selection of case studies of relevance to UNIDO's ITCs. Collectively, moreover, these measures provide an innovation systems perspective on what otherwise might be regarded as a list of unrelated policies. The strength of this Framework thus lies in the complementarity of these measures in supporting different elements of the innovation system and in fostering closer interactions within it.

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[9] The European Inventory of Research and Innovation Policy Measures was is jointly developed jointly by ERAWATCH and INNO-Policy TrendChart and is .implemented by the European Commission's Directorates General for Enterprise and Industry and Research and the Joint Research Centre's Institute for Prospective Technological Studies.

Table 1 Policy framework for the European Inventory on research and innovation policies measures N° & title	Specific objective of the measure
1 - Governance & horizontal research and innovation policies	
1.1 Support to policy making (policy intelligence)	**1.1.1** Strategy policy documents **1.1.2**. Activities of official advisory and consultative forum **1.1.3** Policy Advisory services (e.g. technology foresight)
1.2 Research and Innovation strategies	**1.2.1** Strategic Technology policies **1.2.2.** Innovation strategies
1.3 Horizontal programmes/measures	**1.3.1** Cluster framework policies **1.3.2** Horizontal measures in support of financing, **1.3.3.** Other horizontal policies
2 - Research and Technologies	
2.1 Research organizations	**2.1.1** Universities, **2.1.2** Public Research Organisations, **2.1.3** Research and Technology Organisation (private non-profit), **2.1.4** Research Infrastructures
2.2 Science-Industry linkages	**2.2.1** TT Support infrastructure **2.2.2** Knowledge Transfer **2.2.3** R&D cooperation
2.3 State aid measures in support of business R&D	**2.3.1** Direct support of business R&D (grants and loans) **2.3.2.** Indirect support to business R&D (tax incentives and guarantees).
3 - Human Resources (education and skills)	
3.1 S&T education	**3.1.1**.Awareness creation and science education, 3**.1.2.** Relation between teaching and research, **3.1.3.** Stimulation of PhDs
3.2 Research personnel	**3.2.1.** Recruitment of researchers (e.g. fiscal incentives), 3**.2.2.** Career development (e.g. long-term contracts for university researchers), 3**.2.3.** Mobility of researchers (e.g. brain-gain, transferability of rights)
3.3 Skills development and recruitment	**3.3.1** Job training (LLL) of researchers and other personnel involved in innovation **3.3.2** Recruitment of skilled personnel in firms
4 – Enterprises	
4.1 Support to sectoral innovation programmes	**4.1.1** Support to sectoral innovation in manufacturing **4.1.2** Support to innovation in services

4.2 Support to entrepreneurial innovation	**4.2.1** Support to innovation management and advisory services **4.2.2** Support to organisational innovation including e-business **4.2.3** Support to technology transfer between firms
4.3 Support to start-ups and access to finance	**4.3.1** Support to innovative start ups **4.3.2** Support risk capital

5 - Markets and innovation culture	
5.1 Measures in support of innovation culture	**5.1.1** Support to the creation of a favourable innovation climate (e.g. awareness campaigns), **5.1.2** Innovation prizes incl. design prizes
5.2 Support to the creation of new markets	**5.2.1** Fiscal incentives **5.2.2** Support and guidelines on innovative Green Public Procurement (GPP) 5.2.3 Impact assessments (on R&I issues)
5.3 Intellectual property protection and standards	**5.3.1** Measures to raise awareness on IPR **5.3.2** Consultancy and financial incentives to the use of IPR **5.3.3** Support to the innovative use of standards

D.2 Case studies

With the innovation systems approach as the point of departure and the discussion of various measures and approaches to support innovation in industry and the broader innovation system that sustains it, four sets of characteristics have been identified as the basis for the selection of case studies to be reviewed here. These are organizational and institutional characteristics, sector focus and activities supportive of innovation in industry. Based on the analysis of UNIDO's ITCs, organizational characteristics include:

- Physical Location: independent facilities/ hosted within another organization.

- Governance Structure: existence of a functioning steering committee/Board, reporting structure (reports to its 'parent' organization on a regular basis), evaluation by its parent organizations at periodic intervals.

- Organizational Structure: hierarchical, flat (Directors of 'Centers' have considerable decisional autonomy), network structure.

- Financing: endowment (directly controlled by the 'Centre'), funding from parent organization, funding by host country, staff on loan from host country, infrastructure provided by host country, contributions to a trust fund, project support.

The case studies were selected in order to reflect a variety of different Governance, Organizational and Financing characteristics and have

different focuses and portfolios of activities. They captured both traditional activities as well as some of the newer practices of organizing networks for the promotion of innovation capacity in industry. The following institutions and centres were analysed with a view to drawing conclusions of relevance for the UNIDO ITCs:

A) UNITED NATIONS UNIVERSITY (UNU)

a) UNU-Maastricht Economic and Social Research and Training Centre on Innovation and Technology (UNU-MERIT)

b) The UNU-Geothermal Training Programme

c) UNU- Institute for Software Technology (IIST)

B) The EU's Enterprise Europe Network

C) ESCAP Asia Pacific Centre for Technology Transfer (APCTT).

The detailed analysis is provided in Annex 4. The following is a number of conclusions derived from the analysis of case studies:

(1) How are international centres, programmes and networks[10] created, funded and managed and what are the consequences of this for their role in strengthening innovation capacity in developing, least developed and emerging countries (hereafter 'developing' countries)?

Centres, networks and programmes can be created in many ways. The UNU example shows that a well defined process for setting up centres is important and that a clear reporting line of the centres to the parent agency is of essence.

Sustainability of centre requires clear funding scenarios. The UNU centres and programmes usually work with endowment funds, which guarantee the centres' sustainability. Such arrangements show that the establishment of such centres were done with long-term institutional perspective in mind.

The EU Enterprise Network demonstrates that instead of setting up new centres, the role of a parent agency can be the creation and support of an international network of institutions that are directed towards their respective host countries industries, but that are networked internationally and benefit from the parent agency's (in this case the EU) support, co-ordination and quality control functions.

Generally, programmes should start small and build as the management team becomes more experienced. Starting with the building of a campus before one knows what research will be done is premature. Borrowed

[10] Centers, programmes and networks are collectively referred to here as 'organizations'.

facilities can save time and money and enable activities to begin to produce some positive output to reinforce the initial choice of goals and/or to provide feedback on what needs to be modified before sunk costs make such modification more difficult.

From an innovation systems perspective, programmes should expand in ways that strengthen the system as well as the actors within it. Focusing exclusively on the latter leaves these vulnerable if centers do not achieve their funding goals and support measures cannot draw more enterprises and other system actors into the process without additional funding.

(2) What kinds of relationships have developed between these organizations and their Headquarters and host countries and which are the most productive from an innovation perspective?

The case of APCTT, while not a good example in terms of effectiveness, demonstrates that international centres can benefit from international ownership. It has currently 14 active members contributing to the APCTT trust fund. An alternative model of international ownership is the one of ICGEB, where approximately 70 member countries make small contributions which complement the main contribution from the Government of Italy.

UNU centres and programmes usually have directors selected through international competition. This is also the case for many other international centres (e.g. the IPT in Trieste, the ICGEB).

Although centres may wish to report to host governments, the main governance channel needs to be the 'parent' agency/organization i.e. UNU as opposed to China, the Netherlands or Iceland, the EU's DG for industry and innovation and not the regions in which the centres are located, UNEP and not the host countries in which the various members of the networks are located. Only in this manner can the consistency and timelines of information sharing and reporting goals and evaluation and auditing processes satisfactorily be achieved.

(3) To what extent do cross-organizational contacts emerge and what positive outcomes have they generated.

Cross- organizational contacts emerged within UNU largely in response to top down directives from the Rectors office sweetened by offers of matching funds for joint research. This was made easier by annual meetings that enabled face to face contact between the Directors of UNU Centres and Programmes and an opportunity for contacts to be made and an understanding of the activities and research strengths of the various organizations to become better known. The Development of the Hydrogen Fuel Cell Projects was of this kind.

E. The context of ITCs within UNIDO

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.

The MTPF is less explicit on the role of technology centres: "UNIDO will also provide technical assistance, methodologies and tools for the creation and strengthening of national innovation systems, the establishment and support of technology parks and incubators, and technology and innovation centres."

Within UNIDO the ITCs are mainly supported by the Technology Promotion Unit (PTC/ITP/TPU) of the Investment and Technology Promotion Branch (PTC/ITP). According to the unit's Terms of Reference (ToR), PTC/ITP/TPU is mandated to: "Establish and/or strengthen international and national technology centres and their networking to enhance North-South and South-South technology flows in order to bring innovation results to the marketplace, facilitate technology sourcing, transfer and acquisition, and assist in managing technological change."

The importance of technology promotion for south-south cooperation is also highlighted in UNIDO's approach to south-south cooperation, which includes the establishment of south-south cooperation centres. Currently two such centres are operational in China and India. The South-South Cooperation component of MTPF 2010-2013 envisages the establishment of linkages between the technology promotion and the south-south cooperation efforts: "As part of its efforts to strengthen South-South cooperation, UNIDO will also enhance the coordination and synergies between its investment and technology promotion centres, thus bringing a large network of resources together with the requisite web-based tools for easy and cost-effective global access to information."

Apart from PTC/ITP/TPU there are also other units providing services to ITCs. In particular, several ITCs have been established and supported by the Energy and Climate Change Branch (PTC/ECC).

ITCs are not the only centres supported by UNIDO. At the *national* and local level UNIDO provides support to many institutions and helps to create new national centres, such as National Cleaner Production Centres (NCPCs), Subcontracting Exchanges, technology centres etc.

The support to NCPCs, which over many years has emphasized the establishment of centres at the national level, is now shifting to a stronger emphasis on creating an international network (instead of an international centre), comparable to the EU enterprise network (advisory centres for SME innovation).

At the international level other UNIDO centres are mainly the Investment and Technology Promotion Offices (ITPOs; based and owned by one host country but catering also to the needs of a number of developing countries) and South-South cooperation centres.

International centres need to clearly differentiated from *national* centres as they are not part of the national innovation system of beneficiary countries and from *international networks*, which consist of members that are directly active at the national level.

F. Concluding remarks on the context of UNIDO ITCs

Tomorrow's industrial processes will need to be knowledge-based, energy and water efficient, resilient and sustainable. Strengthening the innovation capacity of industry is essential in meeting these objectives. Although" (t)he relevance of UNIDO's original mandate to support and promote industrial development of developing countries and countries with economies in transition continues to be valid"[11], the ways in which this will need to be done, have changed considerably since this goal was first articulated. In the present context, access to a wide range of knowledge inputs, an emphasis on continuous learning and innovation in both new and traditional industrial sectors, networking and collaborative partnerships have become keys to sustainable industrial development.

Currently, the institutional characteristics, organizational structures and practices of UNIDO's ITCs often do not meet the requirements of innovation and knowledge-based competitiveness. Thus it will be necessary to reconceptualize the ITC program as a whole, and not merely to restructure selected ITCs. In this regard important lessons can be learned from the case studies.

In sum, the context analysis in this chapter has provided a number of insights into the ways in which UNIDO's International Technology Centers might strengthen their relevance and effectiveness in the new context. As a starting point UNIDO will need to reflect on

- How such centers might contribute to knowledge creation and problem solving in new and mature industrial technologies in the developing countries;

- How they might promote local learning and linkage formation to support innovation in industry in developing countries;

- The type of relationship between UNIDO and the ITCs with regard to ownership, quality assurance of ITC services, long term funding, reporting lines, etc.

- How they might become partners in building networks through which research, knowledge, information and technology flow to industry in the developing world can be strengthened.

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[11] GC.11/8,IDB.30/23 (24 May 2005)

- How they might work more closely with other parts of UNIDO and whether ITCs are expected to serve as a source of UNIDO competence in certain technology fields or industrial sectors.

- What functions UNIDO ITCs should have with regard to innovation and technology transfer. Based on the review of case studies and taking into account the typology of support measures used by the EU the following list of categories could be used by UNIDO for strategy planning:

    - Research: provide research grants, including for the mobility of researchers, support access to research facilities, engage in joint research & problem-solving with local research institutes.

    - Technology development & diffusion: national certification & testing processes, local technology reference centres, demonstration projects, awareness building, assists the development of technology applications to local contexts.

    - Linkages: Promote processes of technology transfer through technology brokering and partnering, and technology collaboration including South-South cooperation.

    - Networking: support/participate in networking for knowledge transfer, including from universities to industry, support/provide advisory services, benchmarking.

    - Financing: assist innovative start-ups to secure funding, support SMEs in the preparation of proposals and business plans for funding.

    - Training: Create or support post-graduate programmes, specialized workshops and training programmes including those related to innovation policy and for the training of entrepreneurs.

- What kind of organisational characteristics and human resources ITCs would require in order to achieve their objectives. In this context it is striking that UNIDO ITCs in general are headed by nationals of the host country, which represents a potentially important barrier to the international outreach of ITCs.

III

Assessment of design and programmatic coherence

A. General quality of project design

The quality of the different ITC designs as reflected in the respective project documents varies but was generally found to be low.

While in ICS there is no project document at all, the ICAMT project document is vague in terms of objectives and outcomes and does not apply a logical framework approach. The ICAMT project document is also silent on the long-term institutional perspective of the centre and UNIDO's role in supporting it.

The evaluation of ICM found that "the project document lacks a detailed description of objectives and information on which countries and partners of ICM was to be targeting. A sharper focus on the institutional establishment of ICM…would have been an advantage."

Similarly the project document for support to SITPC is not based on a logical framework approach and the scenarios for sustainability and international ownership are not well described.

The ICHET project document, on the other hand, is a more focused document, describing to a large extent the expected institutional path of the centre. As it described well the underlying assumptions of ICHET (most importantly an imminent break through of hydrogen technology and massive demand) it was a useful instrument of the assessing project relevance in the mid-term review of the centre.

A frequently found shortcoming of ITC project design is the confusion between the objectives of UNIDO assistance and the centres' own objectives. As for many of the ITCs the resources channelled through UNIDO represent only a small fraction of their overall budget, it is necessary to clearly define how UNIDO's project will contribute to overall objectives of the ITC.

B. Common elements of design and programmatic coherence

Besides the "quality at entry" of project documents in terms of generic quality criteria (see above) the "specific quality" of ITC project documents is of interest. In other words, in how far ITC documents are addressing the specific issues involved in establishing/supporting an institution for the purpose of technology promotion and innovation.

One of the most important factors that distinguish an ITC from a regular TC project is the **long-term institutional perspective** that is required from the outset. For example, typical support projects for NCPS establish a medium- to long term goal for the centre to become self-sustainable, based on income from sales of services to private and public sectors, including donors. In the case of ITCs this issue has been addressed only in a few exceptional cases. For example, SITPC states that, similar to an NCPC, the centre might reach sustainability through provision of services in the IT service market. On the other hand , for reasons of potential market distortion, this raises the question whether such a "service provider"- type of centre should be a UNIDO supported ITC.

Another element of the institutional perspective is the **issue of legal entity** of the ITCs. The two biggest ITCs (ICS and ICHET) envisaged to become, in the long run, independent international organisations (following the example of ICGEB). However, the path that would lead toward that ambitious goal was not mapped out clearly and as a result, the necessary steps were never part of the projects activities. On the other end of the spectrum is ICAMT where the issue of legal status of the centre had not been addressed at all in the project document. As a result ICAMT is operating as a UNIDO project office.

A question that follows directly from the institutional perspective is the one of **UNIDO's role and function vis-à-vis the ITC** and how this role/function is supposed to evolve over time. Only in one case (ICHET) has the project design addressed the issue of an exit strategy for UNIDO. Also the requirements for and ITC to form part of UNIDO's international network of ITCs have not been mentioned in any of the documents, due to the lack of an overall strategy for such a network. The role of UNIDO can be expected to change over time. The experience of the NCPCs has shown that very clearly. The initial phase of setting up NCPCs has led to the need to re-define the role of UNIDO once the NCPCs had become independent and the required capacity had been installed[12].

The role of UNIDO vis-à-vis an ITC **at the beginning** can be either:

a) a partner to strengthen an existing institution's capacity to act as an international centre
b) one of several partners engaged in establishing a completely new institution

The role of UNIDO vis-à-vis an ITC **once the centre is up and running** can be:

a) a member organisation obtaining know how from the Centre and using the centre to deliver services (e.g. as a subcontractor to implement projects)
b) a host for a network of ITCs, defining requirements and standards for participation in the network.

As has been mentioned above, ITC project design has usually not defined the different roles and functions of UNIDO vis-à-vis the ITCs. This would be a first step to develop a more coherent strategy and approach. Figure 1

[12] Thematic evaluation of the UNIDO UNEP cleaner production programme, UNIDO, 2007

below shows a possible generic intervention logic that takes into account the different roles of the ITC itself on the one hand and of UNIDO on the other. For individual projects or centres a more specific intervention logic could be developed on the basis of the generic one. However, for the ITCs analysed by this review none has included a detailed intervention logic in the project document.

C. Conclusions on design

The design of projects to establish/support ITCs, contrary to, for example, the design of projects to establish/support NCPCs, was not guided by a strategy or any other conceptual document. This lack of guidance resulted in a 'case-by-case' approach of designing ITC projects.

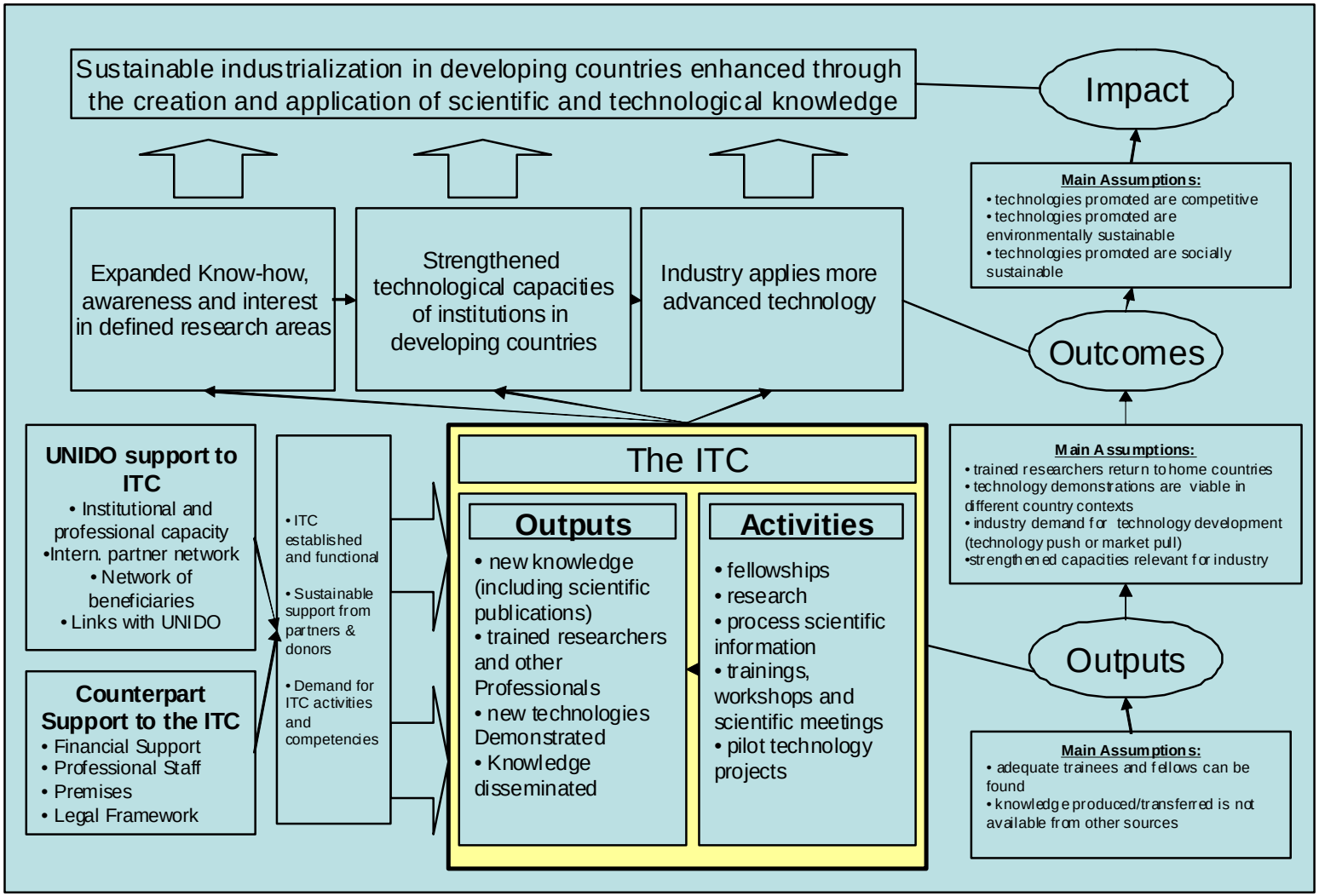
On top of the lack of strategic guidance, the quality of design of many ITC support projects was very low as many important design elements were missing, most importantly a clear intervention logic.

The establishment of institutions, as opposed to temporary TC projects, has specific requirements and challenges for project design. For example, the long-term nature of institutions means that some degree of flexibility is required for the implementation of recurring annual work programmes and not all of the activities can be planned in advance as in the case of TC projects. Issues of long-term institutional perspective, legal entity and UNIDO exit strategies need to be properly addressed in ITC project documents.

This calls for a clearer distinction of the activities, outputs and objectives of the ITC itself and the activities, outputs and objectives of the UNIDO support to it. It also requires developing realistic scenarios for of how the relations of UNIDO and the ITCs can evolve over time. A lot can be learned here from the NCPC experience.

Figure 1

Generic Intervention Logic for UNIDO International Technology Centres



IV
Assessment of implementation and results

A. Core activities and outputs of ITCs

Most of the ITC activities were initially institution building activities, targeted at the establishment of the Centre. In that regard, the focus was on mobilizing funds and long-term support for the ITC. Once the ITC had been built, activities shifted from institution building activities to providing services and carrying out technology promotion activities by the Centre itself.

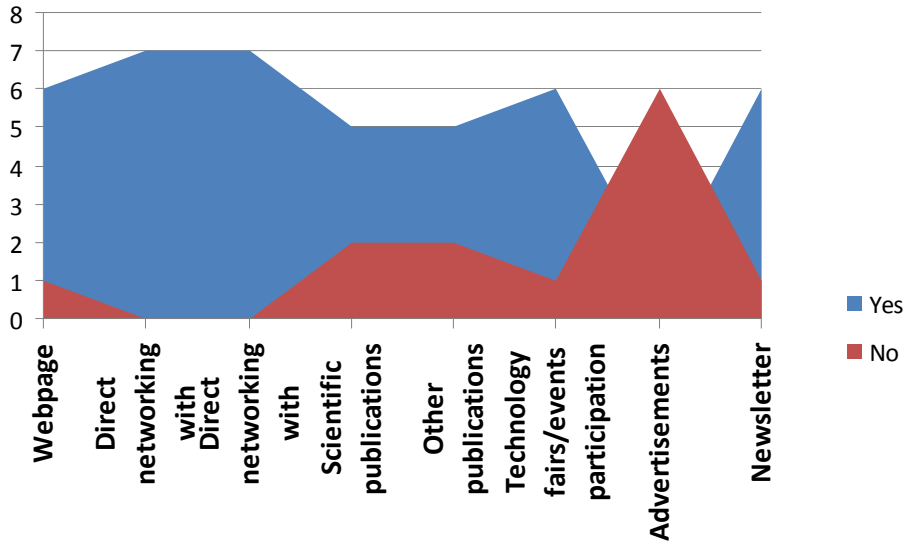
Since there are no general terms of reference for the ITCs and no common approach is used, the focus of activities varies largely. It can range from , information dissemination and conduction of training to the organization of fellowships and conferences, the implementation of demonstration projects, technology assessments and research and development (R&D).

Additionally all Centres are engaging also in activities to achieve visibility of their services and of the technologies they promote. Six out of eight ITCs that are covered in this chapter maintain a homepage, but only in two cases this is used for web-based services like e-learning (ICS) or calls for project proposals (ICHET). As one can see in Figure 2 (next page), networking is an important activity, followed by technology fair participation and contributions to publications.

Table 2 (next page) depicts the spectrum of the different activity focuses of ITCs, ranging from centres that could almost be regarded as training providers (SITPC) to centres with a stronger research outlook (ICM, ICS, ICHET).

ICAMT in Bangalore focuses on the promotion of manufacturing technology and particularly serves the machine tools, plastic manufacturing, foundry, light engineering and auto components industry. ICAMT conducts technology assessments and provides technical assistance and advisory services to enterprises. It engages also in business partnership development through the organization of visits for Indian producers to national and international trade fairs or companies. In the course of these activities, manufacturers from India get exposed to international markets and companies and can share knowledge and learn from each other. ICAMT also provides training in India on issues of manufacturing technology. Most of the ICAMT activities are taking place within India or for Indian clients (e.g. study tours abroad).

Figure 2: Methods to achieve visibility of the ITC



Source: Survey conducted by EVA (2010).

Table 2: Core activities of different ITCs

	ICAMT	SITPC[13]	ICM	ICS	INSHP	ISEC	ICHET	ITPC Shenzhen	Counts
Information Dissemination					□				1
Information systems development				□					1
Technology assessments	□				□	□	□		4
R&D			□			□	□		3
Training	□	□	□	□	□	□	□	□	8
Fellowships			□	□		□			3
Technical Assistance and Advisory Services	□				□	□			3
Conferences						□		□	2

Source: Survey conducted by EVA (2010) and SITPC evaluation report.

[13] The SITPC did not participate in survey. The evaluation report (2010) reports on activities that are mostly training seminars, workshops, and study tours.

SITPC (Shanghai) almost exclusively implemented training activities focused at the dissemination of IT information and acquisition of IT knowledge. The activities take place in China and the Asia pacific region equally and therefore SITPC does not have the strong host country focus of several other ITCs. Apart from the core training activities, SITPC engages in different projects, for instance the upgrading of digital library facilities and developed some e-learning programmes in cooperation with the Shanghai Education Commission among others.

The ICM Beijing operates in the field of building materials and mainly serves the cement, concrete, and building materials.sector. R&D, one of the core activities of ICM covers areas like the use of different raw materials and hazardous waste. Activities by ICM range from applied research in cooperation with a Vietnamese company to technical assistance to Chinese suppliers of cement. Additionally, ICM carried out specific assignments for UNIDO related to the buildings and housing sector.

Another important area is the organization of trainings which include information on clean technology, energy efficiency, healthy materials and materials technology. ICM has also been acting as co-organizer for international workshops, seminars and symposiums targeted at the cement sector.

A major activity of ICS in Trieste is to promote scientific research and provide opportunities to researchers and scientists of developing countries to develop their knowledge and get exposure to scientific programmes. In this context it has a fellowship programme, which awards fellowships to individuals from developing countries and countries in transition, coming especially from Africa and the Asia/Pacific region. The fellows play also a role in ICS's own scientific research and about 50 percent of the fellows produced some kind of research paper.

Since the beginning of ICS, there were a large number of different research areas. In 2008 ICS re-oriented its strategy and now focuses on the following four core programmes:

- biofuels – next generation biofuels and bio-based products
- drug design – rational drug design and development
- geothermy – geothermal energy
- nanotechnology – nanotechnology.

In addition to the new focus, ICS tries to expand its own in-house research capacity through laboratory infrastructure and attracting highly qualified key researchers. However, so far ICS' own research played a minor role in the overall activities.

In addition to fellowships and scientific research, ICS Trieste, like all of the other ITCs, also organizes workshops, trainings and expert group meetings.

Most of these events are taking place in developing countries, among them also least developed countries like Zambia, Senegal, Mali and Tanzania. In 2008, a total of 766 participants from developing countries were taking part in these events.

Furthermore, ICS Trieste places increased emphasis on e-learning to disseminate knowledge and reach and even wider audience and is exploring possible partnerships in this area.

IC-SHP in Hangzhou acts as a promoter of small hydro power technology, mostly in developing countries. An important aspect of its work is the involvement in small hydropower projects where it acts as a technical advisor, designing plants, conducting feasibility studies, supervising the implementation. It also sets up small hydro plants in poor rural areas in developing countries in cooperation with UN organizations and national governments. In the course of these projects the IC-SHP also trains the staff that will later be responsible for the operation. Another core activity is the dissemination of information through the internet (its homepage), own material (newsletters, brochures, etc) and contributions to relevant technical publications.

Furthermore, IC-SHP provides training in the form of short-term courses, on-the-job training in its member countries that are organized in cooperation with governments and international organizations (UNIDO, UNDP, GTZ, etc).

ISEC in Lanzhou engages in a variety of activities targeted at the promotion of solar energy technologies. On its homepage it states that it “is mainly engaged in the studies and application of new and renewable energy, and solar energy technique, domestic and foreign technical cooperation and training, technical consultation and exchange, new product research and development on solar energy, technology promotion and transfer on solar energy in particular.”

The variety of products the Centre provides is vast, ranging from the design of solar water heaters to solar water treatment solutions and the construction of methane generation pits. Here, ISEC is active in capacity building and training activities, conferences, study tours and workshops, the demonstration of solar technologies through its demonstration plants and exhibitions, technical assistance and the publication of training materials and scientific research achievements.

The ICHET in Istanbul is promoting hydrogen technology, mainly for the energy, logistics and transportation industry, so far mostly in Turkey. Initially it engaged in general hydrogen advocacy and networking through missions and participation in international hydrogen meetings and a considerable focus has been on the establishment of a permanent ICHET campus.

ICHET changed its strategy and now focuses on more specific pilot and demonstration projects, which so far have been almost exclusively implemented in Turkey (the only exception is the H2 driven three-wheeler

project in New Delhi). In this regard ICHET is a unique example of a more technology development-focused ITC.

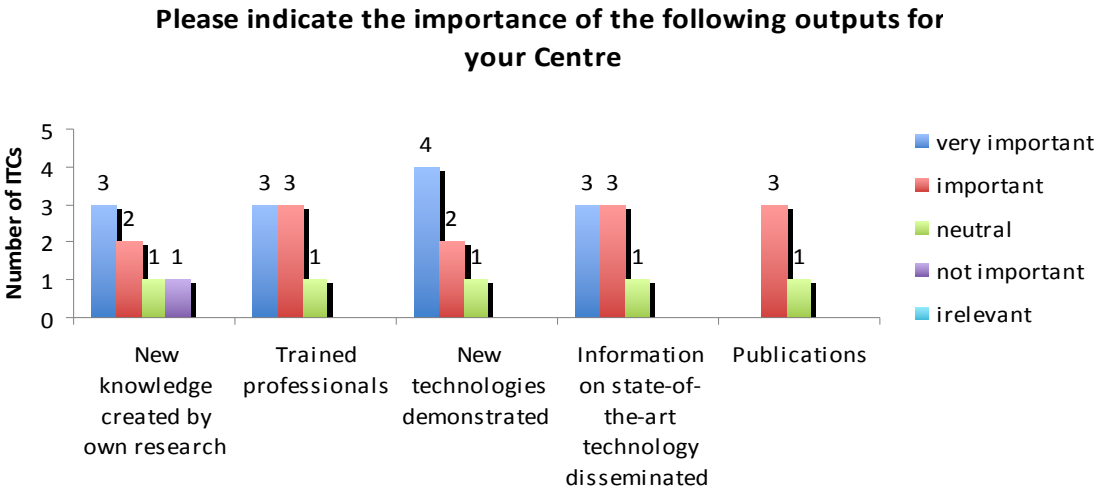
Another area of work for ICHET is the support of feasibility studies, also through the provision of funding. ICHET is also organizing training courses, laboratory exercises, and exhibitions. It supports R&D efforts of universities and makes available its test laboratories.

The ITPC in Shenzhen is promoting clean energy and environmental related technologies like wind power generation technology. Its core activity is the organization of business conventions and forums, workshops and conferences. As an example one can mention the Annual Shenzhen International Workshop on Renewable Energy Technology and Investment. Additionally, it awards the "Bluesky Award" for new technologies for renewable energy utilization that aims at stimulating technology transfer and investment into promising technologies. Most of the partners of ITPC Shenzhen are located in China and only 10 percent of beneficiaries are located in developing countries.

From the above it is clear that the ITCs have different approaches. Although almost all of them engage in training activities and disseminate information on their respective field of technology, their services and activities vary.

However, when it comes to outputs, the picture looks more homogenous (see Figure 3 below). While all ITCs contribute in some way to trained professionals and the dissemination of state-of-the-art technology, there are a few ITCs which also create new knowledge. ICS Trieste, ICM in Beijing and ICHET in Istanbul have got the largest focus on R&D and therefore go beyond the pure demonstration and dissemination of knowledge. However, it should be noted that in the case of ICM most of the research capacity is with the host institutions CBMA.

Figure 3: Rating of importance of outputs for the ITCs



Source: Survey conducted by EVA (2010).

In conclusion it can be said that training is by far the most important activity of the ITCs and only few of them are involved in own research and development (R&D).

B. Institutional characteristics of ITCs

All ITCs were established through a UNIDO project but they differ in terms of their independence. Whereas two centres – ISEC and IC-SHP – are fully independent entities, ITPC in Shenzhen and ICM in Beijing operate as subsidiaries of existing organizations.

IC-SHP[14], ISEC, ITPC Shenzhen and ICM are non-governmental organizations. The other ITCs (ICS Trieste, SITPC, ICAMT and ICHET) on the contrary are managed as UNIDO projects and thus are not a legal entity in their host country. This means that they have to rely on UNIDO legal entity when they enter into agreements with other parties.

All ITCs have a counterpart organization[15] but only some have a host organization[16].

As one can see in Figure 4 (next page), most of the counterpart organizations are ministries and departments related to the technology being promoted: in the case of IC-SHP the counterpart is the Ministry of Water Resources (MWR), for ICHET it is the Ministry of Energy and Natural Resources and for ICAMT the Department for Industrial Policy and Planning (DIPP) which is the nodal Ministry for UNIDO in India. All the ITCs in China (ISEC, ICM, SITPC and ITPC Shenzhen) have the China International Center for Economic and Technical Exchanges (CICETE), which is an administratively autonomous government agency, as their/one of their counterpart(s). Additionally, ICM covers the Ministry of Science and Technology (MoST) and the Ministry of Foreign Trade and Cooperation (MOFTEC) as counterparts.

For some of the centres the main counterparts are local government institutions. For example, the SITPC counterparts are the Municipality of Shanghai, the Information Office of Shanghai Municipal People's Government and the regional Cooperation Office for City Information (RCOCI). For ITPC in Shenzhen, the Shenzhen Municipal Government, Boao Forum for Asia, China Renewable Energy Society act as counterparts. ICS Trieste is a special case, since it is a scientific institution operating within the legal framework of UNIDO. Although it receives its funding

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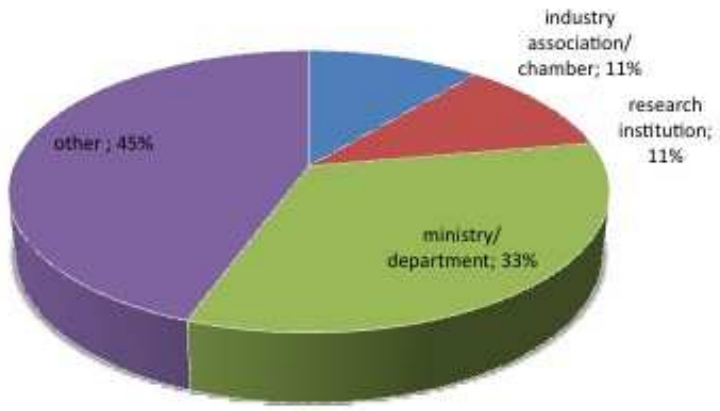
[14] The IC-SHP functions as a secretariat of the International Network on Small Hydro Power (IN-SHP), which has 260 members worldwide. The IN-SHP is registered as a non-governmental organization in China.

[15] Counterpart: Government authority that is officially responsible for the ITC. The counterpart is UNIDO's partner with regard to the ITC and the ITC reports to this organization.

[16] Host: Institution (in most cases a research or technology organization) that provides physical space to the ITC and cooperates wit the ITC at the operational level, sometimes including the sharing of resources.

Figure 4: Type of counterpart organization



Source: Survey conducted by EVA (2010) and SITPC evaluation report.

through UNIDO, it is governed by an Institutional Agreement between the Government of Italy and UNIDO. The official counterpart is the Ministry of Foreign Affairs.

While all Centres have at least one counterpart and several even have more than one, not every Centre has got a technology-based host organization. Examples for the later are ICHET and ICS. For many other ITCs the hosts provide important contributions in terms of substantive input as well as resources.

ICAMT is hosted by two host organizations which play different roles: the Building Materials and Technology Promotion Council (BMTPC) in New Delhi and the Indian Machine Tools Manufacturing Association (IMTMA) in Bangalore. However, their role in providing substantive support to the activities of ICAMT is relatively limited, compared to Centres such as ICM and SITPC where the host institutions are providing the entire staff of the centres.

ICM Beijing is hosted by China Building Materials Academy (CBMA) which is the leading research organization in the field of building materials and inorganic non-metallic materials in China. SITPC is hosted by the Shanghai Internet Economy Consulting Center (SIECC) which was founded by the Shanghai Municipal People's Government and is a self-dependent professional unit. These two centres are examples of host institution driven ITCs that can hardly be regarded UNIDO centres.

ISEC in Lanzhou is being implemented under UNIDO's Renewable Energy Programme. According to ISEC it consists of the Administration Office, several research divisions or labs, a Testing Center for Solar Product

Performance and Quality Inspection, a Computer Network Center for Solar Energy Information and 10 laboratories concerning different fields. ISEC also owns two Experiment and Demonstration Bases of Solar Energy, three development entities and one Solar Building Design Institute. Around 100 scientists, experts and researchers from around the world work at the centre. It has 6 researchers, who have obtained the national level expert titles, 20 more senior scientific researchers, 30 more intermediate and 40 primary researchers or staffs. This impressive volume of resources stands in relation to a relatively small UNIDO project budget of approx. USD 100,000 p.a. over the last 5 years, indicating that the host institution plays a major role in ISEC.

ITPC in Shenzhen is hosted by Shenzhen Energy Group Co, a state-owned enterprise engaged in conventional and new energies. Similar to ICM and SITPC, the "…ITPC draws heavily on the technical competence and backing of the host institution and counterpart agency SEC with 160 experienced professionals and a strong R&D capacity. [17]"

With regard to the resource contributions from host organizations, there are also different arrangements. For example, the BMTPC in New Delhi provides the premises, housekeeping services and administrative support for ICAMT. ICM is located in premises, which are provided by its host. ICHET has no host and functions as a "stand alone" organization, this is also the case of ICS. ITPC in Shenzhen receives from its host (Shenzhen Energy Group Co.) cash inputs, office space and advice from specialists. Additionally, the Shenzhen Municipal Government provides policy support for ITPC's activities and the Mayor is even the chair of the steering committee.

An important aspect of support is staff that is paid and contracted by the counterparts and seconded to the ITC. In Table 3 (next page), the total staff per ITC and the number of staff seconded by the counterpart are shown.

For example, there had never been a permanent project staff assigned to ICM and the only person on a UNIDO contract was a national consultant at the time of the evaluation. Correspondingly, in SITPC all of the five staff members were seconded by the counterpart. The situation is completely different for ICS and ICHET, where most of the staff is directly paid by UNIDO project funding.

In conclusion, the roles of counterparts and hosts in the ITCs vary widely. There are ITCs that are so close to the host that they can hardly be distinguished from it and there are ITCs that function independently without a host or without substantial interactions with it (ICAMT).

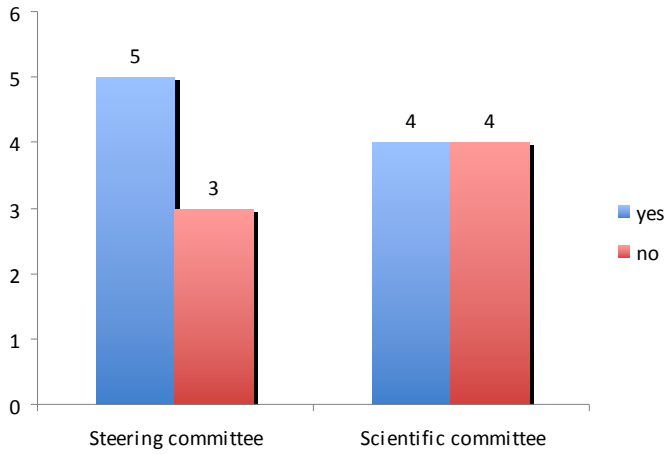
[17] Independent Evaluation of the CSF China, UNIDO 2005

Table 3: Staffing of ITCs

ITC	Mgmt.	Prof.	Admin.	Contracted by hosts	
ICAMT	2	2	3	-	0%
SITPC	2	2	1	5	100%
ICM	2	2	2	6	100%
ICS	2	10	13	no host	0%
IC-SHP*	3	20	5	?	?
ISEC*	13	6	10	?	?
ICHET	5	11	10	no host	0%
ITPC Shenzhen	2	7	3	12	100%
** For ISEC and IC-SHP the information available is not conclusive, but in both cases the host plays an important role in staffing the centres*					

Source: Survey conducted by EVA (2010) and SITPC evaluation report.

Figure 5: Establishment of committees in ITCs



Source: Survey conducted by EVA (2010) and SITPC evaluation report.

Management and governance mechanisms of ITCs

Figure 5 above illustrates that five ITCs (ICAMT, ICM Beijing, ICS Trieste, ICHET and ITPC Shenzhen) have got a steering committee for governance. Out of these five ITCs, four also have got a scientific advisory committee established. However, as we will see in the following, the composition of these committees, the level of activity and the functions vary.

The evaluation of ICM in Beijing (2010) found that its steering committee (16 members) was never active and although according to the survey an advisory committee seems to exist (exclusively representatives from China), the evaluation was not aware of it.

ICS Trieste has got both a steering committee and an advisory panel in place which play a key role in the strategy and coordination of activities. The steering committee is composed of four members of whom two are representing the host government (Italy, one member comes from UNIDO and one member from a developing country. The high-level scientific advisory committee includes a total of eight members from institutions in developed (UK, Italy, Switzerland, Singapore) and developing countries (India, Ethiopia, Malaysia), out of which there are three Noble Laureates.

ICHET has recently (2007) established the originally envisaged steering committee and scientific advisory committee which both provide inputs and oversight of the Centre's work programme. The steering committee is composed of five members, including representatives from the host government, UNIDO, the donor (Turkish Ministry of Energy and Natural Resources) and industry representatives. Interestingly, despite the strong focus on Turkey, its scientific advisory committee includes five members from other countries.

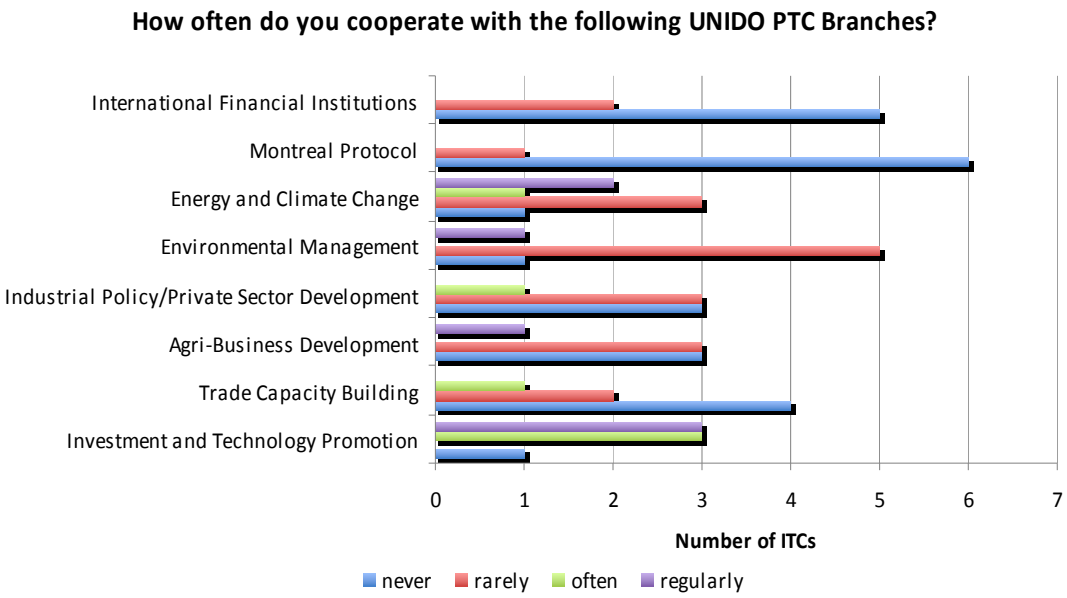
The ITPC in Shenzhen is governed by a steering committee and the ITPC executive board. Its European Energy Manager (EUREM) training course and certificate programme is supervised by a special EUREM China Program Management Committee. There is also a scientific advisory committee composed of 10 members of whom six are from China and the others come from the UK, Germany and the USA.

C. Cooperation within UNIDO

The ITCs do not operate in isolation but are part of a larger technology network consisting of counterparts, beneficiaries and partners. However, the cooperation and integration with UNIDO varies largely and often there is a very limited attachment to UNIDO. The tables below provide an overview of the level of cooperation with the current UNIDO technical branches and UNIDO's field offices. Naturally, cooperation with the branches which provide technical backstopping - the Investment and Technology Promotion Branch and the Energy and Climate Change Branch – happens on a regular

basis. With the other branches there does not seem to be much cooperation and in most cases several ITCs stated that the level of cooperation was not sufficient. Although five ITCs are engaged in environmental technology, only one of them cooperates regularly with the Environmental Management Branch and five ITCs state that they interact rarely.

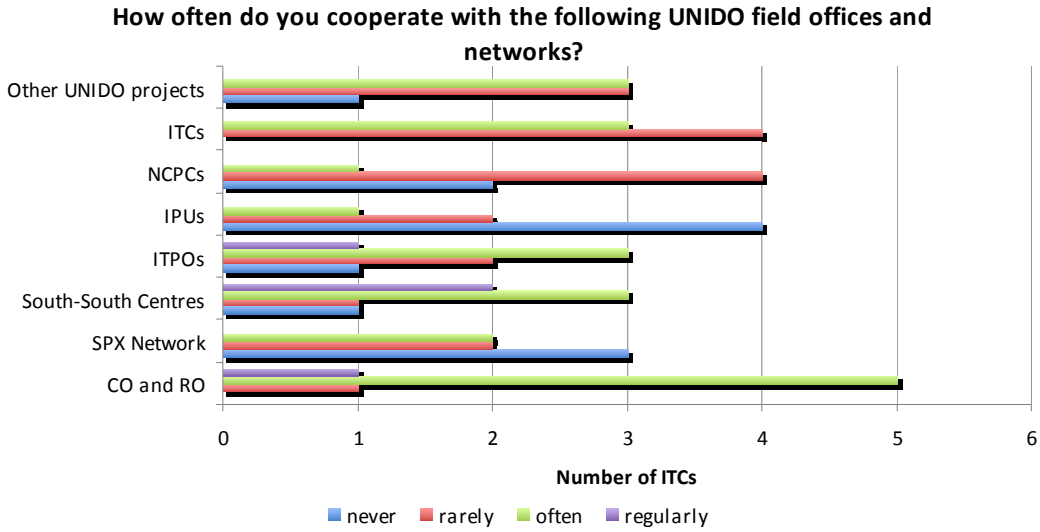
Figure 6: Level of cooperation with UNIDO branches



Source: Survey conducted by EVA (2010).

This trend becomes especially evident in China, which is the host country for several technology and investment related projects and centres. There are two ITPOs (Beijing and Shanghai), four SPXs, a South-South cooperation centre in Beijing and the largest number (five) of ITCs. However, from the evaluations of SITPC and ICM Beijing it emerged that there is limited coordination and the large number of centres is not being used as a network, although like all ITCs in China they are part of the country programme. In both cases, efficiency was rather achieved through the synergies with their counterparts and not the cooperation with other UNIDO projects and activities.

Figure 7: Level of cooperation with UNIDO field offices



Source: Survey conducted by EVA (2010).

However, there are cases of synergies within UNIDO: For example, ICS provided support to the Cleaner Production Unit to train experts from selected National Cleaner Production Centres (NCPCs) and there was also work on degradable plastics in the past which was found to be relevant to the large UNIDO network of Cleaner Production (CP) Centres and on non-combustion technologies for the destruction of Persistent Organic Pollutants (POPs) which was used by the UNIDO POPs unit. Similarly there are cases of ICAMT involvement in projects for low-cost housing and ICSHP involvement in small hydro power projects in Africa.

D. How international are the ITCs?

With regards to the international nature of the ITCs two aspects have been analysed: the geographical outreach of activities and networks and the degree to which target countries participate in the ITCs decision making processes (international ownership).

ICAMT has a broad network of partner organizations in India and stated that 50 percent of its partners are located in its host country. With regard to beneficiaries even more (70 percent) are Indian, as most of the projects are targeting Indian industry.

Although SITPC is limited mostly to training-related activities, its geographical orientation is more diverse. The evaluation found that out of the eighteen activities it conducted between 2001 and 2008, half of them were international, with a focus on the Asian-Pacific region.

ICM in Beijing mainly engages in outward promotion of Chinese technology (e.g. transfer of Portuguese technology, through a Chinese company to Angola, of Chinese cement technology to Vietnam, of Chinese low-cost housing technology to Morocco (in progress) and of low-cost housing technology to South Africa), which limits the international status and orientation of the centre. However, it has also facilitated inward technology transfer (e.g. the introduction, to China, of special latex technology from the US). Through ICM there has been enhanced access of Chinese stakeholders to international experts and technologies and of recipient country stakeholders to Chinese experts and technologies, but the full international dimension of ICM is still to be developed.

ICS is based in a developed country but its outreach to the rest of the world is large. ICS is engaged in the creation of new knowledge and dissemination of scientific information on a global scale. Its fellowship programme has a very international outreach: in 2007, 18 fellowships were awarded to participants from Africa (28%), Asia/Pacific (33%), Europe (17%) and the Americas (17%). In 2008, 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 ICS, 44% by universities in Italy and 5% by universities in Germany.

Also, in 2008 out of its 22 scientific events (training programmes, workshops and conferences with an average duration of 3 days), eight events were carried out in Italy and the rest in different developing countries, among them 4 Least Developed Countries (LDCs) and they welcomed a total of 766 participants from developing countries. Through the establishment of a web portal and e-learning facilities, ICS Trieste provides new knowledge for an even wider audience.

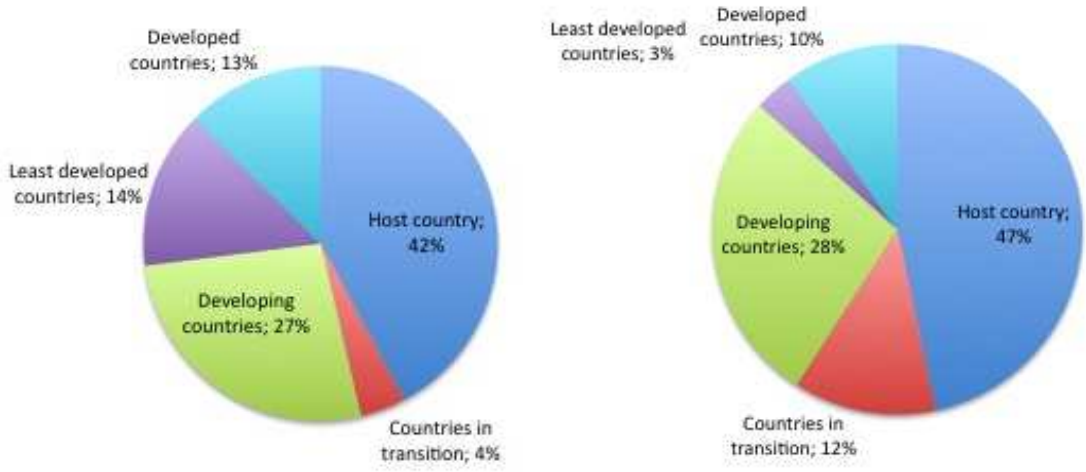
Although there is no individual evaluation available for the IC-SHP, from its homepage the range of projects seems well balanced geographically. Despite of several government funded projects in China, it has already participated in several projects in Africa (e.g. Mali, Ghana, Zimbabwe) and Asia (e.g. Sri Lanka, North Korea). The focus in the beginning of its existence was more on China and gradually seems to have been extended to countries in Asia and Africa. A programme which aims at the construction of 100 small hydro power demonstration units was designed by IN-SHP and is implemented together with UNIDO.

Also, IC-SHP was involved in the establishment of sub-centres in Asia (UNIDO Regional Centre for Small Hydro Power in Kerala, India), Africa (UNIDO Regional Centre for Small Hydro Power in Abuja, Nigeria) and Latin America (CELAPEH in Colombia is IN-SHP's Latin American sub-centre) in order to better serve developing countries. However, the status and outreach of these sub-regional centres is not known.

ICHET has a large network of partners in Turkey, mostly employs Turkish staff and implements the majority of its projects in Turkey.

Figure 8 below illustrate the average geographical composition of beneficiaries and partners of the six ITCs, which responded to the respective question in the survey. Although ITCs are supposed to be – by definition – international, it is striking that most of the partners of the ITCs and correspondingly almost 50 percent of beneficiaries are located in the host country. As regards other developing countries and particularly LDCs – the main target group for UNIDO – they only constitute one third of the ITCs partners and beneficiaries. However, one can argue that since all ITCs except of ICS Trieste and ICHET are located in developing countries, there still is a focus on the developing world.

Figure 8: Location of partners (left) and beneficiaries (right) of the ITCs
(average of six centres)



Source: Survey conducted by EVA (2010).

From an institutional ownership perspective none of the ITCs is truly international. Relevant cases of international ownership outside the UNIDO framework are the recently established International Renewable Energy Agency, IRENA, or, to some degree, the UNIDO off-spring ICGEB. In both cases the governing body of the centre includes representation of member countries.

Also the case studies described in chapter II have stronger international ownership than most of the UNIDO ITCs as the role of the sponsoring international organisations (UNU, EU, UNEP, ESCAP) is more prominent than the role UNIDO plays in most cases.

From the activity perspective the picture is more varied and the case of ICS demonstrates that local ownership does not necessarily prevent

international outreach. However, the overall performance in terms of international outreach of UNIDO ITCs could definitely be better. The self assessment of ITCs reveals that not even a third of the beneficiaries are in developing countries. The ownership aspect might be of importance in this context.

Table 4: International outreach of ITCs

	International outreach of activities			International ownership of the ITC		
ITC	**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
ICAMT	□			□		
SITPC		□		□		
ICM			□	□		
ICS			□	□		
IC-SHP			□	□		
ISEC		?		□		
ICHET	□			□		
ITPC Shenzhen		?		□		

Source: Survey conducted by EVA (2010) and various evaluation reports.

E. UNIDO implementation modalities and UNIDO support

Implementation modalities vary largely and depend on factors like the legal status of the ITC and its attachment and cooperation with the counterpart.

A good indication for the degree of affiliation of the ITCs with UNIDO and their respective counterparts is the type of contract of their staff. As one can see in the table below, ICHET and ICS have all of their staff members employed by UNIDO. These two Centres can therefore almost be seen as UNIDO divisions, operated by UNIDO project and regular staff. In the case of ICHET, the Managing Director is on a L-contract while the previous Managing Director of ICS was listed as Assistant Secretary General, making him the second highest ranking individual of UNIDO.

In contrast, the ITCs in China are much closer linked with their counterparts in terms of personnel and rely on them for most of their staff.

Table 5: Staff on UNIDO and counterpart contract

ITC	UNIDO contract			Contract by counterpart
	L-contracts	SA/SSA	P/G	
ICHET	8 L-staff , 3 N-A, 1 N-B		5 G staff	
ICS	5 L-staff	4	1 Assistant Secretary General 12 G-staff	
ICAMT		2		
ICM Beijing	All five staff is seconded from CBMA (longer or shorter periods)			
SITPC	All five staff members are paid by counterpart.			
ITPC Shenzhen	No UNIDO staff			12
IN-SHP	No UNIDO staff			4

Source: Survey conducted by EVA (2010, various evaluation reports and personnel reports as of August 2010.

As already stated before, SITPC, which is managed as a UNIDO project, is closely interlinked with its counterpart organizations. They provide not only important organizational and logistical support to SITPC and its entire staff is seconded by SIECC.

Although according to the survey, UNIDO plays a role in strategic, administrative and formative issues (work programme, procurement, recruitment, etc), UNIDO does not play a significant role in the implementation of projects, nor does it provide significant technical management and backstopping and therefore quality control is very limited.

Although ICM is a UNIDO project and set up within the legal framework of UNIDO, it is essentially managed by its counterpart, CBMA. CBMA being a research institution is able to provide the Centre with good technological support, while UNIDO would have needed significant budget allocations in order to actually operate ICM. UNIDO's backstopping officer visits the Centre during his yearly missions and the field office in China informs ICM

about UNIDO regulations. However, monitoring has been weak and work programmes, progress reports and annual reporting to UNIDO are lacking.

ICS was established as a subsidiary body of UNIDO by decision of the Industrial Development Board and is principally governed by the Institutional Agreement between the Government of Italy and UNIDO. The Italian support to ICS was codified in a national law and thus modifications of the yearly budget and other major changes would require approval by the Italian Parliament. UNIDO does not have any formal technical responsibility by the Agreement and therefore its role is limited to the administrative and financial management of the Italian contributions to ICS and the overall approval of the ICS programme and budget.

The Centre is headed by a Managing Director who is a UNIDO staff member. More than ten other staff members are also employed by UNIDO. Nevertheless, no substantive branch of UNIDO is performing quality control over the ICS's scientific outputs and limited monitoring is done of technical activities and outputs.

The IC-SHP is also a special case. It is an independent association directly under the Ministry of Water Resources and globally the headquarters of the International Network on Small Hydro Power (IN-SHP) which was co-founded by UNIDO and UNDP. While the Centre handles daily administrative affairs, the highest decision-making body is the Coordinating Committee (CC) which is composed of Chair, Vice Chairs (voted by the members every three years) and members. It is responsible for the approval of the Network's work plan, financial arrangements, voting and appointment of Directors.

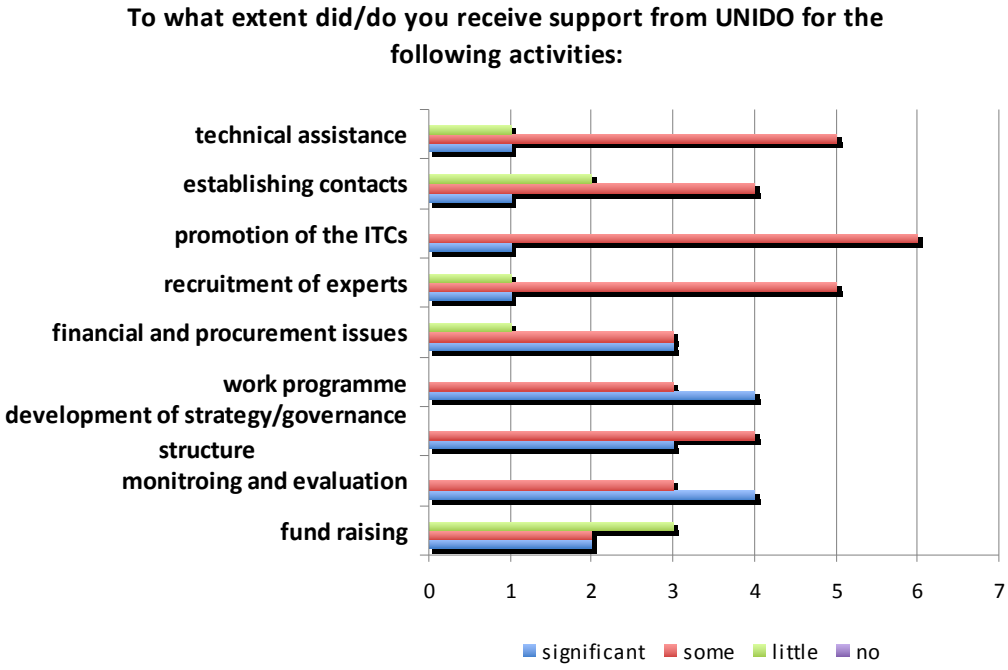
The evaluation found that ICHET, although not being a legal entity on its own, has made considerable efforts to establish procedures that are in line with UNIDO requirements since its restructuring. However, ICHET operates in a very specialized field and thus also needs flexibility, especially with regard to its partnerships with the private sector. Therefore it has established a special kind of Memorandum of Understanding (MoU) with a technical annex, containing the technical description and inputs to be provided by the respective partners. However, there is still a risk that projects are launched without any prior UNIDO quality control and alignment to UNIDO objectives and principles.

Although the ITCs all have specific objectives and mandates, the objectives and scope of UNIDO's support to the ITCs are not allways clearly defined. In several cases, UNIDO's role seems to be confined to providing a legal foundation and necessary administrative functions like the employment of staff and procurement (e.g. ICS). Also (as described above) the recent independent evaluations found in all cases (ICS, ICM, SITPC, ICHET) that quality control is very limited, often due to the lack of capacity for conducting technological backstopping.

Figure 9 below illustrates the results from the survey, indicating that UNIDO support was strongest in the development of work prorgrammes, the

strategy and governance structure and monitoring and evaluation. UNIDO seems to be least relevant for fund raising activities, although in the case of ICHET it was an essential facilitator to channel GEF funding to one ICHET project.

Figure 9: UNIDO support to ITCs



Source: Survey conducted by EVA (2010).

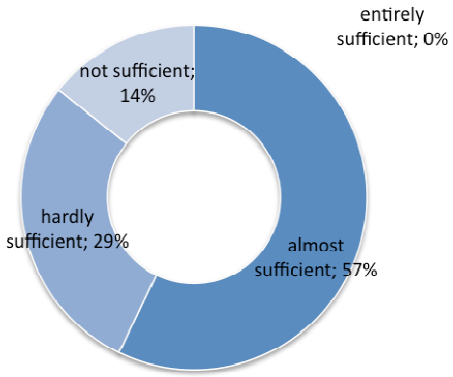
Based on the information available, UNIDO implementation modalities for ITCs are twofold: one group of Centres is managed by UNIDO staff (L-series contracts) with the centre itself being a UNIDO project without proper legal identity (ICS, ICHET). As the centre budget is channelled through UNIDO these centres are fully agency executed; contracts and procurement follow UNIDO rules. ICAMT is implemented somewhat different from this model, as it is staffed with short term project staff (SSA contracts). But it does not have host-staff assigned to it and does not have a separate legal entity. This seems to be problematic as the SSA type of contract is hardly appropriate for long-term co-operation initiatives such as ITCs.

The second group of centres is managed by their host institutions. They have their own legal entity in the host country and UNIDO provides technical assistance to the centre through short term consultants (SSA contracts) and training. While the ITC itself applies its own rules and procedures, the TA provided by UNIDO is executed through UNIDO HQ.

F. Funds mobilization and donor cooperation

"Funding expectations were too optimistic and also not revised in the course of project implementation (particularly the ITCs)". This general finding of the evaluation of the CSF in China in 2005 which especially referred to the ITCs, is quite representative for the funding situation for the Centres today. The figure below shows that for none of the ITCs, which took part in the survey, funding had been estimated to be sufficient.

Figure 10: Is the funding of the Centre sufficient?



Source: Survey conducted by EVA (2010).

While the ITCs seem to agree on the insufficiency of funding, they vary in terms of the sources of their funds. On average, most funding is direct host government or donor funding, while only a limited amount of funding comes from the private sector in the form of fees for services offered.

As regards the role of UNIDO, one can see a basic distinction between Centres, which are funded directly by their host governments, and Centres, which receive their funds through UNIDO. Table 6 (next page) provides an overview of funding levels and arrangements for the recently evaluated ITCs:

From the Table it becomes clear that there are three ITCs which receive significant funds from host Governments through UNIDO: ICS in Trieste, ICAMT in Bangalore and ICHET in Istanbul are all mainly financed from their host governments, channeled through UNIDO. The Chinese Centres receive much less funds through UNIDO and are more dependent on direct in kind or financial contributions from their counterparts and host governments.

Table 6: Funding through UNIDO projects

ITC	UNIDO projects	Curr.	PAD	Donor	funding
ICAMT	TF/IND/95/001	USD	151,665	India	"Funds raised for the operation of ICAMT came from the Indian Government through a UNIDO trust fund". (IE 2006)
	SF/GLO/99/005		845,460		
	SF/GLO/02/004		1,148,435		
	SF/GLO/08/009		600,000		
	US/GLO/08/010		600,000		
SITPC	TF/RAS/08/002	USD	24,876	China	"The approved project funding of US$ 1,1450,000 did not materialize, and only US $152,169 were provided". "The essential in-kind contributions have not been substantiated or reported upon by SITPC, and estimates or actual costs are not available".
	TN/RAS/08/002		338,636		
	TF/RAS/02/001		1		
	TN/RAS/02/001		48,390		
	XP/RAS/01/022		24,520	UNIDO Regular Budget	
	XP/RAS/02/022		74,278		
ICM	TF/GLO/02/006	USD	126,194	China	"The main source of the ICM project budget has been the Industrial Development Fund (IDF) as well as contributions in kind provided by the CBMA. In addition there has been funding provided by MOFCOM under its South-South cooperation funding window and, moreover, the UNIDO South-South Centre in China has financed specific ICM activities, such as missions to Afghanistan and Morocco
	TN/GLO/02/006		121,247		
ICS	TE/GLO/07/106	EUR	60,952	CEI	"With the long-term and continuous funding from the Italian Government, ICS can be defined as organizationally and
	TE/GLO/04/105		22,529,130	Italy	
	TF/GLO/04/105		6,253,436		

					financially sustainable".
IC-SHP	US/RAF/07/002	USD	176,991	China	No individual evaluation conducted
	XP/RAF/07/004	EUR	74,995	UNIDO Regular Budget	
	YA/RAF/07/037	EUR	3,605		
ISEC	US/INT/05/004	USD	265,487	China	No individual evaluation conducted
	US/INT/09/016		265,487		
ICHET	TF/INT/03/002	USD	27,793,380	Turkey	The UNIDO-ICHET USD 40 million Trust Fund agreement between Turkey and UNIDO was signed on 21 October 2003. The major weakness in terms of sustainability is the issue of long-term core funding for ICHET operations (once the USD 40 mn are spent).
	TF/GLO/92/020		86,935		
ITPC Shenzhen	TF/GLO/02/002	USD	81,788	China	Original plans were USD 970,000 contribution from China and USD 1mn to be raised from donors.
	TN/GLO/02/002		100,134		
	TF/GLO/05/022		56,431		
	TN/GLO/05/022		52831		

Source: UNIDO Infobase.

Thus, the degree to which the ITCs are under UNIDO's control varies widely. Three Centres (ICS, ICHET and to some degree ICAMT) can be regarded under potentially strong UNIDO influence, although this influence is not always actively used. The other centres are closer to their counterparts and hosts than to UNIDO. Evaluations have criticized the lack of quality control from UNIDO side in these centres, as their activities are often carried out under the UNIDO flag.

G. Conclusions from the comparative review of ITCs

The design of UNIDO projects that create new or support existing ITCs is not based on a common approach or programme framework. It is, thus, not surprising that the ITCs are a very heterogenous group of organsiations. From the beginning it should be kept in mind that contrary to what the term

"UNIDO ITCs" suggests, the ITCs are in no case part of UNIDO's organisational structure.

Activities and outputs: Training and workshops are the most prominent activities for ITCs, while only very few engage in their own research. Therefore, all ITCs contribute in some way to trained professionals and the dissemination of state-of-the-art technology, while only a few create new knowledge.

Institutional characteristics: UNIDO ITCs do not have common institutional features, i.e. there is no "UNIDO model" for ITCs. Their individual set-up largely depends on their host and counterpart organizations and funding arrangements. Some ITCs don't even have a legal entity and are being managed as UNIDO projects so they can hardly be assessed as constructs with institutional characteristics.

The roles of counterparts and hosts in the ITCs vary widely. There are ITCs that are so close to the host that they can hardly be distinguished from it and there are ITCs that function independently without a host or without substantial interactions with it (e.g. ICHET, ICAMT).

Cooperation with UNIDO: Although the notion of an ITC network exists there is no formal HQ based unit responsible for ITCs. This is in contrast to the International Technology promotion Offices (ITPOs) which have their ITPO Coordination Unit and the National Cleaner Production Centres (NCPCs) which have a substantive branch providing support and networking services (e.g. annual meetings, common strategies and methods). The individual evaluations have shown that there is only very limited technical input and quality control from UNIDO to ITCs. This is especially problematic for those ITCs that are managed by host institutions but use the UNIDO name for their activities.

Some of the ITCs specialize in technical areas that are not among UNIDO priority sectors and where no substantive capacity is available at UNIDO HQ (e.g. building materials, information technology, manufacturing technology/machine tools, geothermy, drug design). While this was mentioned in some of the individual evaluation as a point of concern, it should be noted that other UNIDO Centres (NCPCs and ITPOs) are also active in such technical areas. It remains to be clarified whether UNIDO's role is technical or managerial in nature. Provided that UNIDO focuses on institution building, management for development results and alignment with member country's priorities the lack of technical capacity at HQ is not necessarily a problem. For example, the UNIDO support to ICHET has contributed sifnificantly to its institutional strengthening, whereas the proven technical competence of ICHET in the Hydrogen technologies field was built up without any specific Hydrogen capacity existing in UNIDO. However, in some cases, where ITCs are understood as an "extended arm" of UNIDO, technical capacity at HQ and alignment with MTPF objectives would be a must.

International perspective: Although their name suggests that the ITCs operate on a global scale, evidence does not support this. There are several ITCs with a clear focus of their activities on their host country. Furthermore, the degree of international ownership of most of the ITCs is very low. At best there is involvement of developing countries' scientists in centres' advisory boards; but in no case is decision making shared among several member countries (as is the case in centres such as IRENA or ICGEB).

Implementation modalities: There is no common approach to implementation and UNIDO's role in the management and/or support of the Centre is generally not defined.
Some centres are managed by UNIDO as the Directors' and key staff are recruited by UNIDO with L-series contracts and UNIDO rules and procedures, including procurement rules, apply. Other ITCs only receive small fractions of their budgets through UNIDO, using short term consultants for provision of services.

As some ITCs are not registered as legal entities in their host countries (they operate as UNIDO projects) they cannot enter into contractual relationships with UNIDO (ICHET, ICS, ICAMT). For those who are separate legal entities the potential to act as preferred UNIDO partner organisations has not been assessed. But in some cases it is not evident why any of the institutions should obtain preferred partner status[18] as the relation to UNIDO is not different from many counterpart organisations world-wide that had obtained capacity building support through UNIDO in the past.

Funding: Most of the funding is provided by the respective host governments, which also explains the limited international ownership and outlook of the ITCs. Interestingly there is not a single case of an ITC funded from bilateral donors outside their own countries.

Only a very limited amount of money comes from the private sector (through the payment of services offered by the ITCs) and therefore financial sustainability as for now is only given in the case of continuous funding from host countries. The generation of revenues from provision of services for fees is in principle possible. However, some centres (e.g. ICAMT) do not have their own legal entity and thus cannot use the potential of complementing donations with (not-for-profit) income from companies. On the other hand, the provision of services should be carefully measured against a possible market-distortion effect if such services can be provided by private companies.

[18] A concept for establishing special agreements with UNIDO partner organizations is currently being discussed in UNIDO. Institutions like NCPCs and ITCs have been mentioned as possible candidates for such partnerships.

V
Overall assessment of the UNIDO ITC approach

A. Comparative assessment of evaluated ITCs

Based on the analysis of context, design and implementation and taking into account the independent evaluations of 5 ITCs (ICAMT, ICS, ICM, SITPC, ICHET) conclusions can be drawn with regard to the standard evaluation criteria: relevance, effectiveness, impact, efficiency and sustainability.

A.1 Relevance

Relevance to developing countries

The context analysis (chapter II) demonstrates that developing countries are facing a new paradigm of global competition. Today enterprises compete on innovation as much as they do on price/cost. No longer is it possible nor desirable for developing countries to base their industrial competitiveness solely on the provision of cheap labor and access to natural resources. National institutions to support industry exist in most countries. But in many cases such national institutions lack access to know-how and the national innovation systems they are part of do not facilitate co-operation and synergies.

Academic literature knows several arguments as to why international institutions are needed. The most prominent argument is that international institutions help states to resolve collective action problems, which arise when states have an interest in cooperation, but are nevertheless unable to cooperate[19].

UNIDO ITCs are intended to help developing countries to advance their individual/national technological capacities by using the synergies of a common institution and the better access an international centre has to knowledge as compared to national institutions. Also, as the case studies (chapter II) have shown, international organizations that serve industrialized as well those serve the developing world alike have established international centres and networks in different ways and there continues to be a demand from industry and support institutions for such institutions. Thus, the concept of ITCs is considered relevant in principle.

[19] Jan Karlas: Neoliberalism and Institutional Form in International Relations: Theoretical Precision and Empirical Challenges, Institute of International Relations, (Prague, 2006)

The relevance of the ITCs for developing countries has been confirmed also by the evaluations of UNIDO ITCs (see table below). However, it should be noted that, while the original objectives of most ITCs are clearly relevant, most of them have not yet managed to live up to the original goals and hence the relevance of UNIDO ITCs as they are currently operating is rather low. A good example is the case of ICHET, where the overall objective relates to supporting developing countries in exploiting the benefits of hydrogen technologies, whereas the actual activity portfolio is almost exclusively limited to the host country Turkey.

Table 7: Relevance of ITCs

	ICAMT	SITPC[20]	ICM	ICS	ICHET	Overall assessment
Relevance						
to Developing countries in general	Relevant from thematic focus and within India, very limited outreach beyond India	Only 50% of activities realized outside China, only Asia-Pacific region	Buidling material sector relevant to dev. countries	Very relevant in general	yet limited, most activities in Turkey; but relevant in principle if more internationalised	ITCs are considered relevant in principle but have not yet managed to become relevant partners outside their host countries
To industry in developing countries	Yes, works mainly with industrial clients	No direct relevance for industry	Yes, in principle	Yes, in principle, but serves mainly the academic sector	Yes, ICHET approach involved industry in pilot projects	Most ITCs are active in sectors relevant to developing countries' industry
to UNIDO	Manu-facturing technology core of UNIDO mandate, overlapping with SS centre	Limited relevance of thematic focus	Relevance through green industry and EE focus	Some sectors (drugs design, geothermy) not directly relevant to UNIDO	Hydrogen technology relevant for renewable energy and energy efficiency programmes of UNIDO	Often the sectoral focus of ITCs is not directly relevant to UNIDO, but the capacity building objective is relevant and in some cases environmental focus makes sectoral work relevant.

Source: ITC evaluation reports.

[20] The SITPC did not participate in survey. The evaluation report (2010) reports on activities that are mostly training seminars, workshops, and study tours.

Relevance to UNIDO

The context analysis and the evaluations of individual ITCs confirmed the establishment of and support to international technology centres to be very relevant to UNIDO. However, there are some issues of concern.

First, the sectoral focus of some of the ITCs is not clearly in line with the industrial sectors where UNIDO has in-house capacity. In particular, none of the ITCs focuses on agro-industries, an area that plays a key role within UNIDO's assistance to industrial development. Second, UNIDO has not developed a strategy or programme to support innovation capacities of developing countries.

These two issues are very much interrelated. Whether ITCs are relevant to UNIDO or not depends to a certain extent on what type of support UNIDO is expected to provide to the ITCs. As long as the UNIDO support to ITCs is understood as the provision of sector specific know-how, several ITCs would not be relevant to UNIDO. However, for most of the ITCs, even those that are clearly aligned with UNIDO's areas of technical assistance (e.g. ISEC and IC-SHP in the field of renewable energy) the role of UNIDO has not been that of transferring know how to the centres. Instead, UNIDO supported the initial design and funds mobilization. It acted as door-opener to developing countries and it helped to build up the institutional capacity of some of the centres. In some cases, the environmental dimension of technology and development, a core area of UNIDO competence, has made UNIDO a relevant partner for ITCs even if the sectors as such were not core UNIDO areas (e.g. ICM).

In conclusion, the relevance of ITCs to UNIDO is currently rather low. It would certainly improve if centres are chosen more in relation to core area of UNIDO technical assistance. However, this alone does not guarantee relevance as long as UNIDO does not clearly define what it is supposed to contribute to and obtain from the cooperation with ITCs. Clarifying UNIDO's role in supporting developing countries' innovation systems and capacities would provide a good basis for positioning the ITCs within the UNIDO technical assistance portfolio.

A.2 Effectiveness and impact

With reference to the intervention logic of ITCs (see chapter III) the effectiveness of ITCs needs to distinguish the UNIDO sphere and the ITC sphere. A very effective UNIDO support does not necessarily lead to a very effective ITC, if the contributions from other partners do not materialize. Similarly, a very effective ITC does not necessarily mean that UNIDO has provided effective support, especially in cases like ICM, where the contributions to the centre from host institutions are much more important than UNIDO's contributions.

Effectiveness of UNIDO support

So far, the contribution of UNIDO to developing the institutional capacities of ITCs has been low in most of the ITCs. Insufficient human resources at HQ are a problem in general as active participation in ITCs decision making requires frequent interaction with ITC management and counterpart/host institutions. In some cases there was also insufficient funding of ITC support projects as only fractions of the original budget could be mobilized (e.g. SITPC).

An important finding of all evaluations is that UNIDO has not managed to help the ITCs become truly international centres. In most cases there is still a strong focus on host countries and the centres have not been able to reduce their reliance on host country support by diversifying their ownership structure. Internationally many cases exist where ITCs, either after an (often very long) initial period of institution building or right from the beginning have attracted other countries' support (e.g. ICGEB, IRENA).

Effectiveness of ITC activities

As has been discussed in chapter IV the ITCs are a very heterogeneous group of institutions. As can be expected, the effectiveness of their activities varies considerably.

Generally there are indications of reasonable effectiveness in terms of raising awareness of new technologies. Effects in terms of increased innovativeness of industry are limited as few centres are working directly with industry.

The current Medium Term Programme Framework (MTPF) for the period 2010 to 2013 states several goals to which ITCs could make contributions. Among others it is stated that "UNIDO's role is to assist developing countries in overcoming these international barriers to technology transfer, facilitate affordable access to adequate knowledge and tailor-made solutions in long-term economic transformation, and ultimately facilitate access to international trade in technology based products. During the MTPF period, UNIDO will take into consideration the current changed global technology scenario and focus its intervention on the promotion, transfer, application and diffusion of new enabling technologies and innovations in developing countries. In this context, UNIDO's assistance on technology transfer both at policy and institutional levels will play a key role in achieving these results."

Furthermore the MTPF foresees that "UNIDO will also provide technical assistance, methodologies and tools for the creation and strengthening of national innovation systems, the establishment and support of technology parks and incubators, and technology and innovation centres."

While the ITCs can be regarded clearly relevant to addressing these goals, it emerges from a comparison of evaluations (see table below) that so far they have not been effective in improving developing countries'

competitiveness through more technology-based products nor that national innovation systems have been strengthened. This is because in many cases the linkages between ITCs and industry or industry-support institutions are weak.

In most cases the ITCs are staffed exclusively with technical experts with limited experience in design and implementation of development interventions. ICHET is a good example. While technical expertise of the centre is very good, there is no know-how with regard to, for example, the management of UN cooperation activities at the country level. This can lead to problems wherever an ITC acts on UNIDO's behalf without ensuring proper alignment of activities with Government policies and harmonization with other cooperation partners' and donors' initiatives.

Impact orientation

For the same reason, generally the ITCs capacity to manage for development results is insufficient and impact orientation is low. No adequate monitoring mechanisms have been established to, for example, trace the longer term effects of trainings. In the case of ICS it remains unknown whether trainees can apply their know-how in industry. Similarly, ICHET does not monitor whether certain hydrogen technology demonstrations, while technically successful, would help to solve real development problems like energy poverty.

Table 8: Effectiveness of UNIDO support, ITC activities and impact orientation

	ICAMT	SITPC	ICM	ICS	ICHET
Effectiveness					
of UNIDO support	Value added from UNIDO HQ mainly quality control and facilitation of international cooperation (e.g. plant visits in other countries). At the technological level it was very limited, partly due to UNIDO HQ capacity constraints. institutional capacity and internationaliza-tion of ICAMT low	UNIDO contribution very limited partly due to lack of funds, partly lack of competence. Internationa-lization of SITPC limited	Contribu-tions of UNIDO to ICM capacity relatively limited (CBMA much more important); ICM not yet sufficiently internatio-nalized	Limited day-to-day interaction in substan-tive matters between UNIDO and ICS; no internatio-nal ownership built	Centre established as planned, substantial in-house capacity built at ICHET; but ICHET not sufficiently international-lized
of ITCs activities	Effectiveness in the different areas of support varies.	Evaluation indicates reasonable degree of	Promotion of Chinese technolo-gy	Fellowship program and trainings	Some very good technology demonstra-

	It is highest in awareness raising and market development and lowest in actual technology upgrading. The reason being lack of resources and focus, which is needed for technology transfer work.	effectiveness of SITPC activities.	effective. Regarding training and research it is difficult to distinguish ICM results from host (CBMA).	largely effective in streng-thening develop-ing countries' scientific capacities; but very limited linkages with industry	tions, but generally weak results focus on "real world" applications of H2 technologies
Impact orientation	impact in terms of development results not assessed; no monitoring of development results.	No impact monitoring; no tangible information on development results of SITPC	No monitoring of develop-ment results of ICM activities	impact on industrial develop-ment limited as weak linkages to industry & innovation	Impact orientation of Centre's work is low; development effects not reported on.

A.3 Efficiency

With the exception of ICS the evaluations of individual ITCs did not report any major efficiency problems. Some evaluations mention good practices that contribute to the efficiency of ITCs. One example is the e-learning platform of ICS, which helps to increase the effects of trainings and seminars by making the contents available to a much wider audience.
Another example is the system that ICHET has developed to allocate funds to co-funding of technology demonstration projects by applying a process of international calls for proposals with a professional evaluation process of proposals received.

A.4 Sustainability

None of the UNIDO ITCs is truly sustainable as an institution. This can be regarded as a major weakness of the ITC "programme" as some of the ITCs have been operating for many years without making progress in terms of institutional sustainability.

With regard to the sustainability of results the lack of focus on capacity building in developing countries represents a major weakness that cuts across all ITCs.

Table 9: Efficiency of ITCs and UNIDO support

	ICAMT	SITPC	ICM	ICS	ICHET
Efficiency of ITC	No major efficiency problems identified.	Centre found to be efficiently managed	Activities and outputs of ICM have been delivered efficiently	High overhead cost, resources spread thinly over a large number of research areas	ITC efficiently managed, good admin system at ICHET
Efficiency of UNIDO support	No major efficiency problems identified.	Evaluation of efficiency difficult as UNIDO and counterpart inputs cannot be clearly separated	Limited use of UNIDO expertise and resources in areas such as investment promotion, CP and EE	Very limited continuous support from UNIDO to ICS; introduction of administrative manual improved efficiency of admin.; however centralized admin causes inefficiencies	Long delays in producing first tangible outputs (technology demonstra-tions)

Table 10: Sustainability of institutions and results

	ICAMT	SITPC	ICM	ICS	ICHET
Sustainability					
of institution	High dependence on continued IDF funding, sustainability not resolved	Host provides support on a sustain-able basis	Host provides support on a sustain-able basis	Institutional capacity built, continuous funding through Italian law	Good institutional capacity built but high dependence on continued donor funding, sustainability not resolved
of results	Direct linkage with industries has produced sustainable contributions to increased competitive-ness; institutional support and capacity-building rather weak	Not assessed	Limited focus on capacity building weakens sustaina-bility of results in develop-ing countries	Indications of sustainable results of fellowship programme; plans for the creation of a network of “centres of excellence” in parner countries might increase sustainability of results	Capacity building effects of technology demonstra-tions need to be enhanced to ensure sustainability

B. ITCs as a UNIDO approach to promoting innovation and technology

Case studies of international centres and networks as well as the experience of some UNIDO ITCs like ICS Trieste and ICHET show that ITCs have a good potential to enhance UNIDO's role in international technology promotion and maybe even to compensate the loss, over the past decades, of sector specific competence at UNIDO HQ.

Several ITCs (ICM, SITPC) are inextricably linked with and entirely dependent on counterparts with regard to staff resources. For these ITCs it is impossible for UNIDO to exercise control over management. Therefore it is very problematic to consider these centres "UNIDO ITCs". The UNIDO sphere of control covers only the relatively small project budget, which represents only a small fraction of the centres budgets. Maintaining such centres as "UNIDO ITCs" can involve serious risks to the organization.

The following are specific conclusions with regard to key evaluation questions (see terms of reference, annex I).

Conclusions regarding the design, intervention logic and the underlying theory of change:

Are UNIDO ITC initiatives based on- and consistent with state-of-the-art knowledge about transfer of knowledge and technology?

> Currently, the institutional characteristics, organizational structures and practices of UNIDO's ITCs often do not meet the requirements of innovation and knowledge-based competitiveness. It will be necessary to re-conceptualize the ITC program as a whole, and not merely to restructure selected ITCs.

Does the universe of different UNIDO ITC support projects constitute a programme based on- and consistent with one underlying theory of change?

> No, the ITCs were established on a case-by-case basis without a common approach or strategy. Currently the ITCs do not have major commonalities. However, there are two distinct groups of ITCs – those that are under UNIDO control and those that are under host/counterpart control.
>
> One of the major shortcomings in ITC design is that issues of long-term institutional perspective, legal entity and UNIDO exit strategies are not properly addressed.

In how far is the UNIDO ITC approach based on and catering to existing needs in developing countries?

> UNIDO ITCs are relevant to developing countries in terms of their sectoral focus and overall objectives. However, many of the ITCs do not really cater to the needs of developing countries in their daily work. Some are too much

focused on their host countries or on promoting technology from their host country.

In this context, a remarkable absence of representatives from beneficiary countries in the ownership structures distinguishes UNIDO ITCs from many international institutions (e.g. APCTT, ICGEB, IRENA) who do involve beneficiary countries much more actively in their decision making.

How does the ITC concept fit into the overall technical cooperation framework of UNIDO? How do ITCs relate concept-and practice wise to other UNIDO interventions, in particular to ITPOs and SSCs?

Tomorrow's industrial processes will need to be knowledge-based, energy and water efficient, resilient and sustainable. Strengthening the innovation capacity of industry is essential in meeting these objectives. ITCs and their potential to promote innovation-based competitiveness in developing countries fit very well into UNIDO's cooperation framework.

However, at present the UNIDO ITCs cannot be considered a homogenous group of institutions. The centres themselves, the nature of support provided to them by UNIDO and the expectations regarding the ITCs' core functions vary widely. There is a remarkable absence of a common UNIDO approach to ITCs.

Furthermore, some of the UNIDO ITCs are not really under UNIDO control and resemble rather capacity building projects that might be handled as technical assistance projects (without labelling them as "centres") or through SS Centres in the future. The ITPO network could benefit from the technology related competence of ITCs if close co-operation and alignment of ITCs with UNIDO TC can be achieved.

The limited control over some of the ITCs also implies considerable risks for UNIDO as these centres keep being part of the supposed "UNIDO Network of ITCs", acting under the UNIDO name but without adequate UNIDO control or quality assurance.

Conclusions regarding the implementation and results of ITC-related interventions

To what extent do ITCs reach target groups in developing countries?

Many ITCs do not have sufficient outreach to developing countries as they focus their activities too much on their host countries (e.g. ICHET, ICAMT). In this context it is striking that UNIDO ITCs in general are headed by nationals of the host country, which represents a potentially important barrier to the international outreach of ITCs. Another weakness is that often the final target group, i.e. developing countries' industries, are not reached as trainings are geared towards the academic and public sectors (e.g. ICS).

However, there are some positive cases (e.g. the direct linkages with industry of ICAMT, the involvement of industry in technology demonstration at ICHET) where target groups have been reached effectively.

Are individual ITC interventions producing the expected results, in particular institutional outcomes in terms of capacity building?

The capacity building dimension has been clearly identified as a weakness of most of the ITCs as many of them focus on awareness raising, training of individuals and promotion of host-country technologies. However, also here positive examples exist. For example, the Delhi 3-wheeler project of ICHET has involved local institutions and companies, combining locally available technology with state-of-the-art hydrogen technology with likely lasting capacity building effects on local technology development. Despite of such positive cases, the role and mandate of ITCs in developing innovation and technology capacities in developing countries needs to be more clearly defined before UNIDO cooperation is initiated.

ITCs have a wide range of activities, but of these training was by far the most important. Only a few are involved in knowledge creation whether through in-house research and development or through collaborative work with scholars and companies. In contrast, the external case studies reviewed in this evaluation (see chapter II) show a quite different pattern. Although they reflect some similarities in the range of activities, there are important differences in the form and focus that these activities take and the extent to which the scope of their activities is focused mainly on the host country or more broadly on countries in the developing world.

Many of the comparison cases take a longer-term view that focuses explicitly on investing local communities, policymakers and enterprises with the knowledge and capability to do things on their own. Training programmes are not one-off exercises, but carry with them a concept of learning and a networking element that provides creates linkages and enables information flows to continue in the future. Such linkages stimulate and support sustainable development and a process of adaptive change overtime. UNU-IIST is quite explicit in this regard. The expectation is that those who participate in software development workshops, learn to develop software on their own and remain linked-in to an open software development network. In contrast, ICS-SHP, while it works with other UN Agencies and is active in many developing countries, its objective is to set up small hydro projects and train local persons to operate and maintain these. There is, however, little evidence that efforts have been made to build developing countries' own capacities to develop and implement small hydro projects on their own.

In the case of UNU-GTP, their effectiveness is confirmed both by the return of participants to jobs at home in geothermal, but even more so by the creation of teams of engineers, scientists and managers capable of driving the geothermal energy movement forward and the dramatic rise in geothermal in energy production in those countries in which a

substantial number of persons have been trained. There is a need to look more deeply at the relevance of UNIDO's ITCs from this perspective.

Is the information on ITC interventions and their results sufficient and relevant (M&E)?

Practically none of the ITCs provides reports beyond the activity level. There is a particular weakness when it comes to reporting development effects of technology-related initiatives.

Conclusions regarding the context of ITC related interventions

Are ITC interventions relevant and effective in the different socio-economic contexts found in different countries?

There is no evidence that ITCs are not relevant to a particular group of countries. Depending on the technologies promoted and demonstrated some ITCs are more relevant to mid-income countries than to LDCs (e.g. ICHET) while the opposite is true for other ITCs (e.g. IC-SHP, ICM).

However, the absence of clear focus of the ITC approach on a limited set of core functions (e.g. strengthening the science-industry linkages or support of business R&D) represents a barrier to an effective linkage of ITCs to UNIDO technical cooperation. Also the lack of results-orientation of UNIDO support to ITCs weakens this linkage.

Are ITCs relevant to strengthen national innovation systems in developing countries?

Establishing and supporting ITCs is in principle a relevant approach to strengthen innovation capacities of developing countries. The objectives of most UNIDO ITCs are also clearly relevant in this sense.

However, technology centres can have very different functions. For example, they can serve as centres of excellence in a certain technology field and aim at generating new knowledge through research, while others will focus on the dissemination of available know-how to countries and institutions with limited access. Currently, UNIDO ITCs span the whole spectrum from fundamental research (e.g. some of the research in ICS) to the provision of technical assistance to companies (e.g. ICAMT).

UNIDO has not yet answered the questions a) what constitutes a UNIDO international technology centre and b) when is there a need for an international institution to be supported or created. An alternative approach to establishing ITCs could be the creation of an international network of (existing) technology centres.

VI
Recommendations and lessons learned

A. Recommendations

The following recommendations can be grouped into two major areas of action for UNIDO:

1) to improve existing cooperation with ITCs
2) to exploit the future potential of ITCs to enhance UNIDO's contribution to technology-based industrial development

1) To improve existing cooperation with ITCs

Clearly define different types of UNIDO support to ITCs

For future ITC support UNIDO should establish a clear distinction between a) setting up a new UNIDO ITC, b) establishing partnerships with an existing ITC ("UNIDO Partner ITC") and c) providing assistance to an existing institution in its efforts to internationalize.

Clearly define the institutional and thematic relationship between ITCs and UNIDO

ITCs should only be considered **"UNIDO ITCs"** if they are controlled and managed by UNIDO and a strong thematic relationship exists with existing UNIDO programmes. Currently only ICS and ICHET can be considered to fall in this category as almost 100% of their funds are channelled through UNIDO and they also posses in-house technology capacity and competence in areas relevant to UNIDO. However, the effective control and management applied in both of theses ITCs requires additional UNIDO attention (see respective evaluation reports).

The ITCs that are controlled and managed primarily by their host institutions but maintain mutually beneficial relationships with UNIDO – including a clear thematic linkage to UNIDO's substantive programmes - should be considered **"UNIDO Partner ITCs"**. The only ITCs that currently show a potential to develop within the short term into such Partner ITCs are ICSHP and ISEC.

For Partner ITCs a standard partnership agreement should be developed that:

- is mutually binding;
- defines the roles and responsibilities of UNIDO, the ITC host and counterparts;
- establishes a "firewall" between the host and the ITC, including clear rules about the use of the UNIDO name and logo;
- ensures that wherever the Partner ITC acts on UNIDO's behalf (e.g. through a subcontract) the objectives, principles and values of UNIDO are adhered to;
- rules out the use of the UNIDO name and logo for commercial purposes;
- ensures that UNIDO ITCs and Partner ITCs acting on behalf of UNIDO have - besides their technological capacities - sufficient capacities in terms of development cooperation.

The ITCs whose funds are not controlled by UNIDO or who do not have a thematic linkage to UNIDO programmes and a mutually binding partnership agreement along the lines described above should be removed from the list of UNIDO ITCs. However, the relationship of those ITCs and UNIDO can continue through regular technical cooperation projects and/or participation in a UNIDO-managed network of technology centres (see recommendations under 2).

Ensure quality of UNIDO support to ITCs

Existing UNIDO ITCs and partnerships should be maintained and new ones established only if the necessary capacity for technical backstopping, quality control and active participation in decision making is available at UNIDO HQ.

Within UNIDO an ITC focal point should be established that monitors the UNIDO relations to the different types of ITCs (see above) and ensures that minimum requirements are maintained and UNIDO rules are complied with.

Wherever possible, field offices should actively participate in the technical backstopping of UNIDO work with the ITCs.

Results based management, including adequate monitoring of results should replace the current practice of reporting on activities only. A future UNIDO strategy for ITCs should include guidance on how to formulate and measure results of technology promotion and innovation support.

2) To e*xploit the future potential of ITCs to enhance UNIDO's contribution to technology-based industrial development*

Develop a coherent UNIDO strategy document

- As a basis for revisiting the existing network of ITCs and before establishing any new ITC, UNIDO should develop a comprehensive strategy document elaborating on the Organization's mandate and role in technology transfer and innovation and positioning ITCs as part of an overarching strategy.

- In line with current international theory and practice, “innovation” instead of “technology” should become the guiding principle of the new UNIDO strategy. Consequently, UNIDO should consider rebranding its “technology centers” into “innovation centers”.
- The role of FDI and how the network of UNIDO ITPOs assists developing countries with using FDI strategically for innovation should be developed.
- The new strategy should benefit from the good practices that some of the ITCs have established (e.g. international call for proposals for technology demonstrations in ICHET, fellowship programme and e-learning in ICS).

Define the role(s) and functions of ITCs

As part of the overall strategy, the document should define: the ITC approach; the different types of ITCs and their corresponding functions; the rationale of how ITCs contribute to overall UNIDO programme objectives; the different types of linkages between ITCs and UNIDO and the different approaches of how UNIDO supports ITCs. Existing programme approaches such as the “Joint UNIDO-UNEP Programme on Resource Efficient and Cleaner Production (RECP) in Developing and Transition Countries” could serve as an example.

The future strategy should distinguish between different types of ITCs on the basis of a number of key characteristics such as:

- Core functions the following list of categories could be used by UNIDO for strategy planning: Research, Technology development & diffusion, linkages & networking, training & researchers’ mobility.
- Core instruments used: fellowships, short-term trainings, demonstration projects, applied research, awards & grants, etc.
- Ownership: UNIDO owned, host country owned, multi (beneficiary) country owned
- Type of linkage to UNIDO: direct linkage to TC sectoral programmes (e.g. POPs research, energy efficiency technology development, etc.); direct linkages to horizontal programmes (e.g. south-south cooperation); in-direct linkage through membersip of network of ITCs (projects that support “non-UNIDO ITCs”)

Benchmark UNIDO ITCs to similar institutions

Based on the review of comparison cases (see Annex) a number of benchmarks could be defined for setting up and maintaining ITCs:

- a well defined process for setting up centres is important and, although centres may wish to report to host governments, a clear reporting line of the centres to the parent agency is of essence.
- From an innovation systems perspective, programmes should expand in ways that strengthen the system as well as the actors within it.
- international centres should benefit from international ownership
- centres should have directors selected through international competition.

Explore a networking approach

UNIDO should consider strengthening the creation of international networks of technology related institutions in developing countries. In this regard, lessons learned should be analysed from the EU Enterprise Europe Network and from the NCPC network, which constitutes a network of national institutions directly linked with industry and benefitting from UNIDO's support and international networking.

B. Lessons learned

The case of UNIDO ITCs demonstrates that without strategic and programmatic guidance a supposed "UNIDO approach" - in this case the ITC approach – produces projects that have weak institutional and thematic linkages with UNIDO. This weakens the potential contributions of such projects and centres to the overall objectives and outcomes of UNIDO.

Centres are usually institutions designed to function for a longer-term, indefinite period, which makes them different from short- to medium term TC projects. The experience of some ITCs has shown that the instruments used by UNIDO for design and management of technical cooperation projects are of limited relevance for what is needed to manage UNIDO's involvement in centres. If UNIDO continues supporting institutions over longer periods, specific instruments and tools need to be designed in order to ensure effectiveness, sustainability and to minimize risks.

Annexes

Annex 1: List of persons and organizations met

A) External sources

AREED: Abeeku Brew-Hammond, Professor & Dean of Engineering at Kwame Nkrumah University of Technology, Kumasi, Ghana, member of the GEA ExComm., founder of KITE, an energy NGO in Ghana and the AREED Partner in Ghana.

European Business Network, Patrick De Smedt, EU Directorate General Enterprise and Industry, Brusselles,

European Business Network, Claire Nauwelaers, OECD, Paris

UNEP, Laurence Agbemabiese, Programme Officer, Energy Branch, UNEP, Paris respon

GNESD, Thomas B. Johansson, Professor, IIEE, Sweden, GNESD co-chair.

GNESD, Daniel Bouille, Barilochi Foundation, Argentina, Center Representative

UNU-GTP, Ingvar Friedleifsson, Director UNU-GTP, Iceland

IIST, S. Chidambaranathan, former Vice Rector, UNU, New York

UNU-MERIT, Professor Luc Soete, Director, Maastricht

B) UNIDO

Apart from the interviews carried out for the individual project (ITC) evaluations, two focus group meetings were carried out during the evaluation process with the following UNIDO staff participating:

Mr. Sergio Miranda da Cruz; Ms. Margareta de Goys; Mr. Peter Loewe; Mr. Lamine Dhaoui; Mr. Mithat Kulur, Mr. Prakash Mishra; Mr. Atsushi Isoyama; Mr. Enver Khan; Mr. Cahit Guerkok;

During a recent evaluation mission to China, the team leader of the evaluation also met with Ms. Dan Liang (UNIDO Director responsible for UNIDO centres in China) and the Director and staff of the International Centre for Small Hydro Power (ICSHP).

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Annex 3: Terms of Reference

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Thematic Evaluation of UNIDO's International Technology Centres

01-03-2010

I. Background and overview

Origin and context of UNIDO's International Technology Centres (ITCs)

UNIDO's Constitution mandates the organization to "promote, encourage and assist in the development, selection, 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" and to "assist in the establishment and operation of institutional infrastructure for the provision of regulatory, advisory and developmental services to industry".[21]

Consequently, UNIDO included technology promotion as one of the priority areas within its corporate strategy. The Medium Term Programme Framework (MTPF) 2006-2009 and the MTFP 2008-2011 include specific references to ITC support. According to the latter, "UNIDO will promote the diffusion of modern and relevant technologies for poverty reduction; particularly through its technology centre network". In the former the relevant passage is: "The pre-eminent outputs of the technology promotion and diffusion component of this service module include: … support and advisory services for the establishment and strengthening of national and international technology centres and technology parks…." and "Advisory services and transfer of best international practices for the operation of technology centres….".

These statements indicate two possible interpretations of UNIDO's vision in relation to ITCs: while the earlier MTPF statement suggests that UNIDO plans to utilize ITCs as a tool for technology promotion (as, for example, the UNIDO's Investment and Technology Promotion Offices are used as tools for investment promotion), the latter MTPF statement has a stronger emphasis on capacity

[21] UNIDO Constitution, 1979

building, i.e. UNIDO being an advisor, promoter and supporter of the ITCs (as, for example, in the case of UNIDO's capacity building support to the establishment of National Cleaner Production Centres).

Furthermore the MTPF 2006–2009 states in regard to the outputs of the technology promotion and diffusion activities of UNIDO: "These outputs serve to strengthen the institutional capacity of national innovation systems, establish and strengthen international and national technology centres, ITPOs and related networks, and upgrade the innovative capacities of enterprises."

The latest UNIDO MTPF for the period 2010 to 2013 is less explicit on the role of technology centres: "UNIDO will also provide technical assistance, methodologies and tools for the creation and strengthening of national innovation systems, the establishment and support of technology parks and incubators, and technology and innovation centres."

Within UNIDO the ITCs are mainly supported by the Technology Promotion Unit (PTC/ITP/TPU) of the Investment and Technology Promotion Branch (PTC/ITP). According to the unit's Terms of Reference (ToR), PTC/ITP/TPU is mandated to: "Establish and/or strengthen international and national technology centres and their networking to enhance North-South and South-South technology flows in order to bring innovation results to the marketplace, facilitate technology sourcing, transfer and acquisition, and assist in managing technological change."

The importance of technology promotion for south-south cooperation is also highlighted in UNIDO's approach to south-south cooperation, which includes the establishment of south-south cooperation centres. Currently two such centres are operational in China and India. The South-South Cooperation component of MTPF 2010-2013 envisages the establishment of linkages between the technology promotion and the south-south cooperation efforts: "As part of its efforts to strengthen South-South cooperation, UNIDO will also enhance the coordination and synergies between its investment and technology promotion centres, thus bringing a large network of resources together with the requisite web-based tools for easy and cost-effective global access to information."

Apart from PTC/ITP/TPU there are also other units providing services to ITCs. In particular, several ITCs have been established and supported by the Energy and Climate Change Branch (PTC/ECC).

The objectives of UNIDO Technology Centres

UNIDO does not have a fully developed strategy or programme that describes the theory of change of the ITCs. However, references on the objectives of ITCs can be found in the UNIDO strategy documents mentioned above in chapter I and in different project- and other documents.

For example, the project document of the UNIDO project to support the International Centre for the Advancement of Manufacturing Technology (ICAMT)" states:

"One of the major initiatives of UNIDO in this area is to establish a technology promotion and transfer network consisting of International Technology Centres. These Centres are considered as a unique tool to promote international collaboration, transfer and diffuse technological knowledge and innovations and buildup technology partnerships thus bridging the technology divide. Each centre has a network consisting of government institutions, industrial associations, R&D institutions, universities, professional societies and funding agencies. Close links of ITCs and their networks with industry ensure that their work programmes continuously reflect the industrial needs of the country."

A UNIDO publication of 2001[22] describes the ITCs as a central element of UNIDO's "technological infrastructure approach":

"Creation and upgrading of Technology Centres:
UNIDO has been active at creating international technology centres in various technical areas. The original purpose of the centres was to increase awareness of new technologies in the developing countries and to allow access to applied research and development and training in these new technologies for participants from developing countries.

Each Technology Centre has a network/sub networks consisting of industrial R&D institutes, universities, industrial associations and professional societies working in the same subject area and having their own networks of partners with strong links to industry. These networks surrounding the Centres provide the opportunity to ensure that the work programmes of Centres reflect continuously the industrial and market needs of beneficiary countries.

Information on expected UNIDO results can be found in the UNIDO Programme and Budget (P&B). The P&B for the period 2006/2007 includes a specific output: "established and strengthened international and national technology centres as well as technology parks". Related expected outcomes are: "Institutional capacity of national innovation system strengthened" and "International and national centres, ITPOs and related networks established and strengthened".
The P&B for the period 2008/2009 includes the programme component "technology diffusion". But ITCs are not explicitly mentioned as planned outputs, target groups or counterparts.
The P&B for the coming biennium 2010-2011 does not have a programme component "technology diffusion" anymore. The most relevant component for ITCs is "investment and technology promotion". Also here no explicit reference to ITCs can be found whereas several technology transfer functions are planned to be carried out by UNIDO's Investment and Technology Promotion Offices (ITPOs).

Apart from the above there is little information available on the UNIDO ITC approach and intervention logic and no fully fledged programme document exists.

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[22] Technological Infrastructure, UNIDO's Approach, June 2001

II. Objectives and scope of the thematic evaluation

This evaluation aims at answering a number of key questions, which will shed light on the relevance, effectiveness, impact, efficiency and sustainability of UNIDO's support to international technology centres (ITCs). It will furthermore contribute to the discussion of UNIDO's future support by formulating recommendations to enhance UNIDO contributions to technology promotion in general and technology centres in particular. Hence the purpose of the evaluation is twofold:

- Contribute to organizational learning by assessing the continued relevance and by identifying strengths and weaknesses of UNIDO technology centre initiatives with a view to enhance performance of projects and upstream activities.
- Contribute to accountability by assessing the achievements of UNIDO's support to ITCs.

The evaluation will cover individual centres as well as up-stream and global forum activities and the network of ITCs, including the degree of cooperation among the ITCs and with other UNIDO centres and offices.

The following ongoing ITCs have been identified for inclusion in the evaluation exercise:

International Centre for Advancement of Manufacturing Technology (ICAMT, Bangalore, India)
UNIDO-Shanghai International IT Technology Promotion Centre, (SITPC, Shanghai, China).
International Centre for Materials Technology Promotion (ICM, Beijing, China).
International Centre for Science and High Technology (ICS, Trieste, Italy)
International Centre for Small Hydro Power (ICSHP, Huanzhou, China),
International Centre for Promotion and Transfer of Solar Energy (ISEC, Lanzhou, China)
International Centre of Hydrogen Energy Technology (ICHET, Istanbul, Turkey)
UNIDO-Shenzhen Environment Technology Promotion Centre (ITPC, Shenzhen, China).
International Materials Assessment and Application Centre (IMAAC, Brazil)
International Institute for Monitoring and Management of Environment, Resources and Resources' Recovery Technologies (UNIDO IMR, China)

To the extent possible, information will be collected also for centres that received UNIDO assistance in the past but no longer maintain close relations with UNIDO, in particular:

International Centre for Genetic Engineering and Biotechnology (ICGEB, Italy, India, South Africa)
Russia-Brazil Centre for Technological Cooperation (RBCTC), Moscow, Russian Federation.
International Centre for Materials Evaluation Technology (ICMET, South Korea)

UNIDO also maintains a network of Investment and Technology Promotion Offices (ITPOs) and South-South Cooperation Centres (SSCs) (currently two of them are operational in China and India with others planned to be established in the near future). The ITPOs and SSCs have objectives that are very similar to those of the ITCs. Thus the evaluation will try to identify the specificity of ITCs vs. the other types of UNIDO centres as well as strengths and weaknesses of the respective approaches and modalities.

III. Methodology

The review will consist of five main components:

1) Review of documents and UNIDO staff interviews

- Review of UNIDO project related documentation: project documents, progress reports, project completion reports, technical reports from subcontractors, financial reports, etc.
- Review of methodological documents, tools and training kits, reference documents and guidelines (if any).
- Interviews with UNIDO project managers and responsible line managers.

The document review will encompass:

- Analysis of UNIDO implementation modalities for ITC support
- Comparative review of the UNIDO support to ITCs in terms of inputs
- Extraction of information with regard to the expected and actual results of ITCs and
- Compilation of information that allows to describe the UNIDO ITC programme theory and to compare it with those of other similar interventions in- and outside of UNIDO.

2) Comparative review of UNIDO evaluation reports of individual ITCs

Recently the following ITCs have been subject to independent evaluations:

ICS – International Centre for Science and High Technology (Italy)

ICHET – International Centre for Hydrogen Energy Technology (Turkey, evaluation yet in process)
ICM – International Centre for Materials Technology Promotion (China)
SITPC - UNIDO-Shanghai International IT Promotion Centre (China)
ICAMT – International Centre for Advancement of Manufacturing Technology (India)

Furthermore the evaluations of Integrated Programmes (IPs) or Country Service Frameworks (CSFs) in countries where ITCs have been set up, in particular the ones in India and China will be reviewed.

The respective evaluation reports will be reviewed to provide answers to the key evaluation questions specified under section IV. For this purpose a framework will be developed in order to compare the approaches, modalities and results of the different centres.

3) *Survey and self-assessment of ITCs*

In order to obtain information directly from ITCs a survey will be carried out (using a web based format and/or structured telephone interviews with the management of the Centres). The survey will include a self-assessment of the ITCs. The information collected will be summarized in a framework similar to the one used to compare the information from ITC evaluations.

4) *Re-construction of the UNIDO ITC programme theory*

Based on the findings from component 1 to 3 and discussions with project managers, a logical model will be developed to describe the cause-effect linkages by which UNIDO ITC support projects intend to achieve their objectives.

To validate the draft programme theory, it will be shared and discussed with UNIDO project managers. Also, opinions of ITC key stakeholders (in particular ITC management) regarding the key elements of the cause-effect chain will be collected through a survey (see above).

5) *A review of current trends and practices in developing and developed countries regarding the role of international and national institutions in the promotion of technology*

The review will be based mainly on available literature and web-based information. It will produce findings with regard to the relevance of the UNIDO approach and the positioning of UNIDO and ITCs vis-à-vis other international initiatives in the field of technology promotion.

The different methodological components will involve different stakeholders, information from different sources and present different views and interpretations of the relevance, effectiveness, efficiency, impact and sustainability of UNIDO ITC support and of the ITCs themselves. This will allow triangulating findings and lead to more robust conclusions.

IV. Key evaluation questions

The key evaluation questions are:

Regarding the design, intervention logic and the underlying theory of change:

- Are UNIDO ITC initiatives based on- and consistent with state-of-the-art knowledge about transfer of knowledge and technology?
- Does the universe of different UNIDO ITC support projects constitute a programme based on- and consistent with one underlying theory of change?
- In how far is the UNIDO ITC approach based on and catering to existing needs in developing countries?
- How does the ITC concept fit into the overall technical cooperation framework of UNIDO? How do ITCs relate concept-and practice wise to other UNIDO interventions, in particular to ITPOs and SSCs?

Regarding the implementation and results of ITC related interventions

- Are individual ITC interventions implemented in line with the underlying theory of change?
- What are the main factors that influence the effectiveness and efficiency of ITC interventions (e.g. institutional anchorage, operational anchorage, access to finance, exit strategy and counterpart contributions)?
- To what extent do ITCs reach target groups in developing countries?
- Are individual ITC interventions producing the expected results, in particular institutional outcomes in terms of capacity building and impact in terms of competitiveness and poverty reduction?
- Are ITC interventions producing sustainable results?
- How do implementation modalities affect efficiency and effectiveness? Is the implementation of ITC interventions in UNIDO organized in an efficient manner?
- What are the different roles of UNIDO and of counterpart organizations? How does UNIDO add value to ITCs?
- Is the information on ITC interventions and their results sufficient and relevant (M&E)?
- To what extent are ITC interventions linked to other UNIDO initiatives?

Regarding the context of ITC related interventions

- Are ITC interventions relevant and effective in the different socio-economic contexts found in different countries?
- Are ITCs relevant to strengthen national innovation systems in developing countries?
- What are the main context factors that influence the relevance of ITC interventions?
- How do UNIDO ITC interventions relate to other support interventions with similar objectives within UNIDO (e.g. ITPOs) and outside of UNIDO (e.g. the Asia Pacific Centre for Transfer of Technology (APCTT) or the International Environmental Technology Centre (IETC)?

V. Evaluation team and timing

The evaluation team will be composed of two staff members of the UNIDO Evaluation Group (ODG/EVA), one of them acting as team leader; one senior international expert in the area of industry and technology transfer; one junior expert and two interns at ODG/EVA to carry out research and support the survey. The tasks of the senior international expert are specified in the job description attached to these terms of reference in annex 2.

UNIDO Evaluation Group will be responsible for the quality control of the evaluation process and report. It will provide inputs regarding findings, lessons learned and recommendations from other UNIDO evaluations, ensuring that the final report is useful for UNIDO in terms of organizational learning (recommendations and lessons learned) and its compliance with UNIDO Evaluation Policy and these terms of reference.

Members of the evaluation team must not have been directly involved in the design and/or implementation of the programme/projects.

The thematic evaluation is scheduled to take place in the period of October 2009 to March 2010.

VI. Reporting

The report should be brief, to the point and easy to understand. It should explain the purpose of the review, what was evaluated and the methods used. The report should highlight any methodological limitations, identify key concerns and present evidence-based findings, consequent conclusions, recommendations and lessons learned. The report should provide information on when the evaluation took place, ITCs covered and who was involved.
It should be presented in a way that makes the information accessible and comprehensible and should include an executive summary that encapsulates the essence of the information contained in the report to facilitate dissemination.

Evidence, findings, conclusions and recommendations should be presented in a complete and balanced manner. The review main report shall be written in English and follow the structure given in annex 1.

A draft report will be shared with the corresponding Programme or Project Officers for comments and factual validation. They may provide feedback on any errors of fact and may highlight the significance of such errors in any conclusions. The consultation also seeks agreement on the findings and recommendations. The evaluators will take the comments into consideration in preparing the final version of the report.

Annex 4: Case studies

UNITED NATIONS UNIVERSITY (UNU)

United Nations University (UNU) was established by the United Nations in December 1973. UNU Headquarters are located in Tokyo and its basic revenue for operating expenses is generated by investment income from its Endowment Fund to which the Japanese Government initially pledged US$100 million[23]. UNU's mission iwas “to contribute, through collaborative research, capacity development and advisory services to efforts to resolve the pressing global problems of human survival, development and welfare that are the concern of the United Nations” (UNU:2009). The definition of these problems has changed over time and this has contributed to the emergence of new centers and programmes with a variety of organizational structures and financing mechanisms.

Under its first Rector, UNU sought to carry out its mission by creating a range of associated centers. Its second Rector moved to develop full-fledged UNU Centers and Programmes and this would later create the basis for a more coherent and focused structure. Currently UNU has 16 Centres & Programmes located in 12 countries around the world.

The process of becoming a UNU Center or Programme can be initiated by governments or other organizations in a potential host country or by UNU itself. In either case, UNU appoints a team to carry out pre-feasibility and feasibility studies. Subsequently, a formal agreement is negotiated between the local centre or programme and UNU. The final decision, however, rests with the UNU Council.

The formal agreement between UNU and host governments covers a number of critical organizational, financial and governance issues. All UNU centers and programmes, even those that are jointly established with local organizations, such as the UNU-Geothermal Energy Programme (UNU-GTP), discussed below, 'belong' to United Nations University and this is specified in the above agreement. They report to the UNU Council at its annual meetings and through annual reports[24], are audited and evaluated by UNU at periodic intervals. Their finances, where these take the form of an endowment, the distinguishing feature of a UNU Centre, are managed by UNU. UNU Centers, however, have considerable discretion in deciding the use of the revenues generated by their endowment. Those opting for a

[23] http://unu.edu/hq/rector_office/faq.htm
[24] UNU-GTP also reports to the Icelandic Government.

multi-year financing commitment in five year tranches, are called 'programmes'[25].

The formal agreement also stipulates that the host government has an obligation to provide office space as part of their financial contribution. Of the three UNU organizations that will be discussed below, two are endowed centres—UNU-INTECH (now UNU-MERIT), endowed at its creation in 1990 by the Dutch Government and UNU-IIST which was established in Macau in 1993 as a UNU Centre endowed by Portugal, PR China and Macao each of which is housed in buildings provided by the host government . In most UNU Centres and Programmes, the post of director, is open to international competition. Though occasionally the host may appoint the first director, that person has not necessarily been a national of the host country[26].

Like many universities, UNU was a collection of separate centres and programmes, each with its own 'sector' specificity. UNU-MERIT provides an example of how the strategies and functions of these organizations evolved overtime within the broader international institutional and organizational structure of UNU.

a) UNU-MERIT

In many ways UNU-INTECH was, and its successor UNU-MERIT is, a traditional academic programme, carrying out research on technological change, innovation and their socio-economic impacts. In its first decade the focus of UNU-INTECH was mainly on research aimed at the academic community and its outputs were research papers and books. Mid-way through that decade it developed a joint Phd programme with the University of Maastricht and supported its students through fellowships. By the early 2000s it had yet to graduate any of its students.

In its second decade the focus of its activities expanded. Three factors stimulated the change process. A new Director brought in new ideas that led to a greater interest in knowledge transfer and capacity building in the area of innovation practices and systems, especially in developing countries. A reduction in administrative staff freed resources to expand into projects related to these new objectives. One of these was the workshop programme on the Design and Evaluation of Innovation Policies (DEIP). Created in 2004 and aimed specifically at policymakers, the training programme grew from one workshop per year held in Maastricht to an average of three per year of which two were held in developing countries and co-hosted by them. In a little over five years (2004-mid-2010), more than 433 practitioners,

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[25] Most UNU Institutes also have outside funding from other UN agencies, foundations or governments as well as project funding for which they have competed.

[26] This was the case, for example, at UNU-INTECH now UNU-MERIT.

mainly policymakers with a small number from universities and the business sector had been trained (UNU-MERIT:2010) and workshops were being increasingly tailored to the specific needs of host countries and regions.

Recognizing that, like many universities, UNU functioned as a set of separate knowledge silos, UNU's Rector created the Joint Activity Fund for the purpose of encouraging collaboration among UNU Centers and Programmes. This top –down initiative stimulated further changes in UNU-INTECH. Using the annual meetings of the UNU Council and Directors of UNU Centres and Programmes to network, a joint project was developed in 2004 to explore the issues, for developing countries, raised by new technologies such as Hydrogen Fuel Cells in the Transport and Energy Sectors. It brought together UNU-INTECH, the UNU Institute of Advanced Studies in Japan where research on energy and the environment was underway and UNU's Geothermal Energy Programme in Iceland. Each UNU Institute contributed financially or in kind to the project which secured additionally funding from Canada's International Development Research Corporation. The Rector's fund matched these contributions. The project created an important network of researchers, policymakers and enterprises in developing and developed countries, organized a major international meeting to create awareness of the need to build capacities in developing countries to make choices about hydrogen and alternative clean energy technologies and took this message to the 15th session of UNCSD in 2007, and subsequently publishing a book on this subject the following year. Having broken out of its silo, UNU-MERIT has continued the tradition of collaborative research across UNU Centers and Programmes with joint research projects with UNU-Wider and other Centers[27].

Having changed its earlier habits and practices, UNU-MERIT was receptive to yet another top-down innovative initiative., With a view to strengthening linkages with developing countries, the new UNU Rector who took office in 2008, launched the concept of twinning UNU and Developing Country Universities and Research Institutes. UNU-MERIT launched its first twinning program with Renmin University China (RUC) which has now expanded to include twinning with RUCs Center for the Study of Globalisation in the International College in Suzhou. UNU-MERIT has also twinned with CRES, in Dakar with whom it will organize two workshops in September 2010, one to train researchers on 'The Economics of Knowledge and Innovation' and the other, a DEIP for policy makers.

[27] In formation in this and the follow paragraphs is drawn from the UNU-MERIT website http://www.merit.unu.edu)April 2010, UNU-MERIT (2010) and UNU-MERIT (2008).

b) The UNU-Geothermal Training Programme[28]

The oil price hikes in the mid-1970s turned attention to the need to develop alternative energy sources. It was no surprise, therefore, that shortly after UNU was created, the idea to establish a UNU Geothermal Institute in Iceland emerged in 1975.

The development of geothermal resources requires a group of highly skilled specialists from a number of disciplines of science and engineering. Because of its diversity, geothermal energy has not been taught as a common subject at universities. The training of geothermal specialists has mainly taken place on-the-job within companies and institutions. But especially for the benefits of the developing countries, international geothermal schools have contributed significantly in the transfer of geothermal technology.

After a first proposal in 1976 and an international workshop in 1978, the Government of Iceland decided in October 1978 to ask Orkustofnun, the National Energy Authority (NEA), to sign an Agreement on Association with the UNU and establish the UNU Geothermal Training Programme (UNU-GTP). The UNU-GTP has been hosted by Orkustofnun since then. The Authority also provides financial support to UN-GTP which in turn hires teaching and supervisory staff from ISOR, the Iceland GeoSurvey and several of the local universities. Between 1979 and 1982 the financing of UNU-GTP Programmes was shared equally by the UNU and the Government of Iceland. Government of Iceland has covered 80-90% of the annual funding.

In it funding structure, UNU-GTP resembles several of the UNIDO ITCs. But the governance structure provides a counterweight to host country dominance. Thus under the formal agreement signed with UNU, Orkustofnun became an associate of UNU. It hosts UNU-GTP and finances a large part of its budget. It also appoints the Director. Nonetheless, the agreement acknowledges that UNU-GTP belongs to United Nations University and reports to the UNU Council at each of its annual meetings. Changes in programme and financing are discussed at that time and approved at that level. UNU –GTP also reports to Orkustofnun but it is the UNU Rector heads the management hierarchy.

Although GTP's main activities are training and research, it does not follow the typical academic model. From its inception its aim has been to assist in establishing groups of specialists in selected institutions in developing countries with significant geothermal potential. The vehicle for this is the six month specialized training programme launched in 1979.

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[28] Information on GTP comes from the following sources: http://www.unugtp.is/Apps/WebObjects/Orkustofnun.woa/wa/dp?id=585

Three innovative practices have helped to ensure that knowledge transfer, capacity development and its applications directly into the production and innovation process is ensured. First, the programme is aimed at professionals and the selection process emphasizes direct insertion upon return. To that end, candidates are nominated by local institutes where geothermal work is already underway.[29] Another is the practice of tailoring individual programmes of the participants in one of nine fields related to Geothermal Technology. These include chemistry of thermal fluids, reservoir engineering, borehole geology, environmental scient, geothermal utilization, geophysical exploration , drilling technology and reservoir engineering. A third is the significant involvement of practical training as well as the development of research projects which are both integral parts of the programme.

From 1979 to 2009, 424 scientists and engineers from 44 countries completed this course. Of these, 43% were from Asia, 28% from Africa, 14% from Central and Eastern Europe and 15% from Latin America. Over 72 participants have been trained from China, 45 from Kenya, 31 from the

Philippines and over 28 from El Salvador and 26 from Ethiopia. Today China is the world leader in the direct use of geothermal energy. Kenya, the Philippines, and El Salvador obtain 10-22% of their total electricity from

[29] http://www.unugtp.is 'Status'.

geothermal Energy and Ethiopia has started its first geothermal power plant.[30]

In the early 2000s, "(a)s part of the Millenium Development goals of the UN, the Government of Iceland decided its contribution would be short courses in geothermal training" (Georgsson:2008). In contrast to the 6 month training programme for scientists and engineers held in Iceland each year, the short course are held in different countries around the world and are addressed more to Decision Makers in Geothermal and to specialized topics. The 'Workshops' are generally co-sponsored by a local energy agency or provider. By way of illustration, the first workshop for Decision Makers was held in Kenya in 2005 with KenGen. The Kenya Electricity Generating Company, as the host. The following year, the series was started in Central America with a 'Workshop for Decision Makers in Geothermal held in El Salvador with LaGeo S.A. de C.V. as co-host. (Georgsson:2008). In 2008 the workshop programme was extended to Asia[31]. Between 2005 and 2009 a total of 8 workshops have been held.). East Africa, particularly within the Rift Valley, has large reserves of untapped potential in geothermal energy[32]. In 2006 a "Short Course on Exploration of Geothermal Resources" was held in Kenya and there has been some discussion of the possible creation of an East African training centre operated by KenGen under the umbrella of UNU-GTP (Georgsson:2008).

c) UNU-IIST

UNU-IIST, the UNU's Institute for Software Technology, is of particular interests as a case study of a Center located in China. First because the functioning of UNU-IIST differs substantially from the ITC cases reported in this evaluation. Like some of these ITCs, however, there were initial problems encountered in securing the promised funding. UNU IIST managed to overcome these. UNU-IIST is also a good examples of how centers, not designed as a network, can become networked, integrating network behaviour into their earlier organizational structures and institutional practices. It will be remembered that network behaviour implies collaborative habits and practices rather than hierarchical approaches to working together (joint research or technology development) as well as openness to knowledge and information exchange.

UNU-IIST started operations in the second half of 1992 as the UNU's Institute for Software Technology. It's Charter emphasized the collaborative nature of its core activity. "UNU-IIST is to serve developing nations in attaining self-reliance in software technology" and listed the specific activities that would make this possible (emphasizing design calculi oriented

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[30] All data in this paragraph are drawn fro the UNU-GTP website on august 31 2010. http:/www. Unugtp.is/ 'status'

[31] On the workshops see http://unugtp.is/page/structure_workshops_and_short_courses

[32] Kenya has received a $330 million USD concessional loan from The World Bank to develop its geothermal resources and ARGeo, the African Rift Geothermal Energy Development Facility , managed by UNEP with funding from the German KFw and the, GEF plans to develop geothermal energy with Partner countries Kenya, Ethiopia, Djibouti, Uganda, Eritrea and Tanzania (Hamlin:2004).

techniques and tools for requirements development, programming and software engineering as well as software technology management through procurement:tendering, bidding, evaluation, selection, negotiation, contracting, conformance testing, &c., and project management through planning,allocation scheduling, resourcing (incl.budgeting and financing), monitoring and control, quality assurance &c. (UNU-IIST:1992).

Within the first five months seven staff members, including the Director, Professor Dines Bjorner[33], the Financial officer, the Principal Research Fellow, a more junior research fellow and a Senior secretary, Secretary and Administrative Assistant were in place and the first groups of trainees had arrived. However, at its first Board meeting, the Biennium budget of USD$ 3.8 million, for 1992-1993 approved by the UNU Council in 1991 had to be drastically downsized pending the arrival of the expected yearly installements of funds for IIST's endowment. "This ratified installment schedule is not being followed. Instead Macau, on behalf of all initial doors, have installed a total of US$ 7 Million by Oct. 15, 1992. Efforts to secure US$ 1 Million ledges for 1992 in 1992 from Portugal and the P.R. of China seem not to have succeeded" (UNU-IIST:1992).

UNU-IIST was also being housed in inadequate facilities. Nonetheless, after 18 months of activity, 150 people had participated in 4 two-week advanced training workshops held in Beijing, Pune, Bankok and Hanoi and one 1-week workshop in Pyongyang. Ten fellows were also being trained for periods of 7 to 12 months at UNU-IIST in Macau and three new were underway or about to start (UNU-IIST:1993). How had UNU-IIST managed to move so quickly, given the financial and space constraints? First, many of the activities in 1992-1993 were held in China. Second, after 11 months, the Governor of Macao agreed to re-house UNU-IIST in much larger temporary premises and 'graciously offered that a fine Patrician Villa…be rebuilt to serve as UNU-IIST's future permanent premises' (UNU-IIST:1993).

As to the financial constraints, workshops which could not be held in Macao or Beijing, were moved to neighboring countries in Asia. Even more importantly, efforts to secure funds from elsewhere were actively pursued. Over the 1990s, several courses and workshops were supported individually by different countries and companies, for example, by CRI Inc. of Denmark. UNU-IIST also began consulting work on new software technology development for the Vietnam Ministry of Finance and the Chinese Government. Under its PRaCoSY project, for example, it trained specialists from the PRC Ministry of Railways' Computer Center in advanced techniques for the conception, specification, design and coding of safety critical, high integrity software for the time scheduling, dispatch, monitoring and control along the busiest 600 km railway corridor in China: Zhengzhou-Wuhan. The project was funded as part of the loan (training) arrangement with the World Bank (UNU-IIST:1993).

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[33] Note that one of 4 Directors has been Chinese.

In 1994 IIST training activities spread to countries across Asia and a year later, they began two week courses in Francophone Africa with funding from the World Bank. As of 10 January 1996, US$29.2 million of the pledged US $30 million had been contributed to the UNU Endowment Fund for UNU-IIST (UNU-IIST :1995). With its financial house in order, UNU-IIST extended its activities to Latin America and gradually expanded its research agenda to include the design and development of university curriculum for formal software development, established new training courses on Software Project Management and Co-design of Hardware/Software Systems and later, with 11 university partners from industrial countries began to train university lecturers from developing countries(UNU-IIST:2001). Over the next decade, UNU-IIST sought to "..balance the need for computing to be seen as a science and major projects" in capacity building (UNU-IIST:2008). New projects, such as one on theories and tools for software technology linked to an EU research consortium, were developed jointly with several partners and are funded by UNU-IIST, the EU and the Macao Science and Technology Development Fund. Following its now well developed, networking approach, UNU-IIST, in collaboration with UNU-INWHEH, has developed projects on tools for predictive computer modeling and decision support in the management of water resources (WaterBase) and established the Centre for Electronic Governence with funding from the Government of Macao SAR, Microsoft Corporation, UNDP, the UN Asia Pacific Center for ICT Development, the UNU Joint Activities Fund and the International Fund for Animal Welfare. The Center has over 25 partners including government ministries from eight developing countries and Korea, Universities from all but three of these as well as Universities in the US, UK, Canada and Eygpt, UNU-MERIT, and a number of UN Agencies (UNU-IIST:2008).

The EU's Enterprise Europe Network

The EU's Enterprise Europe Network grew out of the earlier European Innovation Relay Centers (IRC). Like its predecessor, the Enterprise Europe Network's focus is on strengthening the innovation capacities of SMEs. This case study illustrates the importance of engaging in a continuous process of dialogue and evaluation that enables the overall programme to meet its objectives through adaptive changes in the centers themselves as well as in their activities.

The European Union was created in the Treaty of Maastricht of 1991. With a view to enhancing linkages between universities/research centers and industry, the European Community had already established a network to facilitate the transfer of knowledge and technology . This would evolve into the network of European Innovation Relay Centers which redefined the concept of transnational technology transfer (TTT) to include transfers between companies and widened the functions to include "(t)he installation and maintenance of a network of centers with a level of service capacity that can deliver successful TTT" (EC:2001,6). Attention was also drawn to the need to "bring benefits to participating SMEs and the regions in which they reside" (EC:2001,6).

The first IRCs, were established in 1995 with the support of the European Commission. At that time, SMEs represented about 70% of the workforce and turnover of EU enterprises and their growth had a positive impact on employment –providing jobs for 117 million persons. IRCs were selected through open calls for proposals on a regional basis and signed contracts, at first for two years and then extended to four year. Location in the regions enabled well functioning centers to develop close relationships with local companies and knowledge of their technology needs.

By 2000-2002 the IRC network consisted of 68 IRCs across 31 countries including EU 15, 10 Central & Eastern European countries (CEEC), Iceland, Norway, Israel, Cyprus and two in Switzerland. IRCs, as a NETWORK, promoted international technology transfer to and from European SMEs through an on-line service that matched firms looking for technology with those seeking to license or otherwise transfer it. They also maintained in-house expertise which was available to all members in the network. The network thus gave SMEs access to a wide range of knowledge, information and practical business experiences.

In 2001 an evaluation of the IRCs revealed the existence of market failures that still needed to be addressed. The EU TTT mechanisms, for example, were "… not turning results into competitive advantage" and obstacles to innovation and technology transfer persisted (EU:2001,7). In the Central and Eastern European countries (CEEC) SMEs were "more likely to buy" than develop technology and innovate. "The import of ready-made solutions hinders innovations" (EU:2001,7) the report concluded. Changes in the existing model were recommended to widen the service range for greater viability, create new financial incentives to stimulate TTT, define targeted clientele and be visible to them, and develop better mechanisms for follow through to ensure that services have the impact desired.

By 2008 there were 230 Relay Centres serving as knowledge and technology brokers and providing business and technology services to strengthen the innovative capacities of SME. A mid-term evaluation, however, showed that the network was still not as effective as it could have been in transferring information and in supporting innovation in SMEs. Many of the Relay Centers were located in the same building as the 235 European Information Centers providing information to SMEs about EU directives, regulations and funding opportunities through EU programmes. It was recommended that these two programmes be merged to create a one-stop shop for SMEs.

The focus also slightly shifted to providing services that would enable SMEs to become more innovative and thus more internationally competitive. The network also internationalized. Firms from Third party countries could now join the network as paying members and thus feature as business or technology partners in their home market for EU SMES. Greater efforts, moreover, were to be made to move the network towards sustainability on its own.

In 2007 new calls for proposals began the process of renewing the centres and their transformation into the Enterprise Europe Network. The 250 Euro Info Centers and the 230 IRCs were merged and joined by 100 newcomers including non-EU countries such as South Korea, China, Russia, Mexico and the United States. The Enterprise Europe Network which officially began in January 2008, will be funded by the EU until 2014[34] (De Smedt:2010).

The Enterprise Europe Network has not only strengthened its role in supporting SMEs but has further developed its impact assessment studies and strengthened its feedback mechanism 'Listening to Enterprises', thus learning more and more quickly how their services are impacting upon SMEs. In its first three years, the renewed network has intensified it business co-operation and technology transfer services, produced or disseminated 11,500 partnership proposals, held a variety of brokerage events in which 15,000 SMEs participated and producing 1,525 signed partnership agreements. Some 75,000 SMEs received specialized advisory services in the form of business and technology reviews, advice on funding and information on intellectual property rights (De Smedt:2010).

ESCAP/APCTT

The Asian and Pacific Center for Transfer of Technology, APCTT, was created by the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) in 1977. It is currently located in New Delhi with host facilities provided by the Government of India[35]. In many ways, APCTT's functions resemble those of the European Relay Centres and their successor the Enterprise Europe Network, notably in their emphasis on SMEs and technology transfer. Both its organizational and financing structure, however are significantly different. In the course of its 30 year history, it has also changed its focus many times. As a brief review of the evolution of APCTT illustrates, these factors have interacted in a quite negative way. Activities have increasingly focused on a small group of countries who contribute to the APCTT Trust Fund"[36] (APCTT: 2009), the relatively small number of contributions to the APCTT trust fund, increased reliance on the donors for project funding and a a resulting tendency to overly extend activities, leading to their limited impact.

Initially the APCTT focused on the transfer of technology and on technology information. Its objective was to strengthen technological capabilities in and technology transfer across its member states with particular emphasis on small and medium sized enterprises (SMEs) (ESCAP:2003,1). APCTT's current website puts this somewhat differently. "The objectives of the Centre

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[34] CIP, from the EU Competitiveness and Innovation Framework Programme (CIP), "which focuses on supporting SMEs in their growth and innovation activities" (EACI:2009), will provide 370 million Euros to 2014 (De Smedt: 2010). The Executive Agency for Competitiveness and Innovation (EACI) is responsible for managing the network on a daily basis" (EACI:2009).

[35] It was originally located in Bangalore.

[36] These include Bangladesh, China, India, Indonesia, Islamic Republic of Iran, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Republic of Korea, Sri Lanka, Thailand and Viet Nam.

are to assist the members and associate members of ESCAP through strengthening their capabilities to develop and manage national innovation systems; develop, transfer, adapt and apply technology, improve the terms of transfer of technology, and identify and promote the development and transfer of technologies relevant to the region" (http://www.apctt.org/about_us/statute.html).

In the 1980s APCTT[37] "reoriented its focus on norms and practices of technology policy formulation, technology development and technology management" and launched the Asia-Pacific Tech Monitor, a bimonthly periodical to monitor technology trends and developments, technology policies and new products and processes. In the 1990s, emphasis was placed increasingly on technological upgrading in SMES and the promotion of R&D and enterprise cooperation. A number of networks were created or announced as forthcoming, in this period. These included Tech-Mart, a web-based market for technology trade between technology sellers and buyers within and outside the region", both partners would pay a fee if an agreement were reached, "Technology4sme" Portals, a "comprehensive web-portal to facilitate " technology transfer and business development with a particular focus on SMEs in the Asia Pacific region", Business e-Coach, "a country specific web-portal that will provide legal information and practical advice for business", Business Circle, "a web-based sector-wise community for business people to explore business opportunities in the Asia Pacific region" and BINASIA, a Biotechnology Information Network for Asia which "aims to promote cooperation in R&D and information sharing. This network was started in 2003 jointly by the Ministry of Science and Technology of the Government of the Republic of Korea and APCTT". This network includes all 14 of the core partners with whom APCTT traditionally collaborates. The credibility, relevance and effectiveness of such a long list of web-sites can be questioned, especially when compared to the much larger and more integrated on-line information and technology partnership network, maintained by the Enterprise Europe Network.

A brief look at the Tech-Mart website, for example, shows the difficulty in attracting seekers and sellers to that site, the relatively non-sophisticated technology that is being offered and sought and the few recent offering. Given the importance now assigned to biotechnology in the APCTT work programme, it is surprising to find only 30 offers, most of which are old --11 from 2007, 2 from 2008, 3 from 2009 and 1 from 2010-- and only 15 posted requests, 11 from 2007 and 4 from 2008. Another sector of some prominence in the current work programme is clean technology. The website listed only 16 energy offers, 14 from 2007, 2 from 2008 and 12 requests, 9 from 2007 and 3 from 2009.

In 2001, the Economic and Social Commission for Asia and the Pacific (ESCAP), one of four regional commissions under the United Nations Economic and Social Council, engaged in a restructuring of its work

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[37] The information in this paragraph is drawn from APCTT:2009.

programme with a view to increasing its relevance to the needs of the region. This led, in turn, to a re-evaluation of ESCAP's regional centers including APCTT[38].

Surprisingly 25 years after its establishment, the evaluators found that APCTT was " not well known throughout the region and even where it is known, there is an apparent lack of interest. Countries feel that there have been limited opportunities to participate in APCTT activities and there has been an imbalance in the delivery of assistance" (ESCAP:2003,5). The evaluation notes that "[m]uch of the work of APCTT is concentrated on low technology, which is more relevant to the least developed countries, while developing countries constitute the majority of the members of ESCAP" (ESCAP:2003,6). This was particularly problematic for APCTT since its core funding comes from contributions by member states to its trust fund. As ESCAP itself acknowledged, "we work with all member and associate member countries of ESCAP but more closely with 14 countries who provide institutional support…and from whom we receive guidance and support" (ESCAP:2009,1).

[38] ESCAP had four regional centers in 2002. APCTT, the Statistical Institute for Asia and the Pacific (SIAP), the Regional Coordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific (CGPRT) and the newly created Asian and Pacific Center for Agricultural Engineering and Machinery was not included in this review (ESCAP:2003).

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