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IMAAC COPPER FORUM & JORNADAS CYTED

TECHNICAL REPORT

Sponsored and Organized by

- International Materials Assessment and Application Centre of UNIDO
- Subprograma XIII - Tecnologia Mineral of CYTED
- Ministério da Ciência e Tecnologia da República Portuguesa, Coordenação Nacional CYTED

UNIDO

IMAAC COPPER FORUM & JORNADAS CYTED

Volume V

TECHNICAL REPORTS AND PHOTOS

Sponsored and Organized by

- International Materials Assessment and Application Centre of UNIDO
- Subprograma XIII - Tecnologia Mineral of CYTED
- Ministério da Ciência e Tecnologia da República Portuguesa, Coordenação Nacional CYTED

ANNEX TWO

TECHNICAL REPORTS

SUSTAINABLE INDUSTRIAL DEVELOPMENT FOR THE MINING SECTOR
(ACTIVITY REPORT for The United Nations Industrial Development Organisation-UNIDO).

by F. E. Novaes Hegenberg[1]

Events: 'Jornadas CYTED-XIII' and 'IMAAC Copper Forum'.
Organised by: *United Nations Industrial Development Organisation-UNIDO; Ciencia y Tecnologia para el Desarrollo-CYTED* (Spain); and *Ministério da Ciência e Tecnologia* (Portugal).
Main Co-ordinators: Professor Roberto C. Villas Bôas (Chairman IMAAC and CYTED-XIII International Coordinator); Professor Manuel Fonseca Almeida (Portugal); and Professor Benjamin Calvo (Spain).
With the Technical Support of: CYTED-XIII (Mineral Technology Programme); International Materials Assessment and Application Centre-IMAAC; Laboratório de Engenharia de Processos, Ambiente e Energia-LEPAE; Departamento de Engenharia Metalúrgica e Materiais-DEMM; and The Pan American Committee on Mining, Metallurgy and Materials-COPAM/UPADI.
Date: from October 25th to November 3rd, 1999 (Workshop and Technical Visits to Mines in Portugal and Spain).
Place: Engineering Faculty, University of Porto, Portugal.
Address: Rua dos Bragas, 4050-123, Porto, Portugal.
Technical Visits: 'In situ' discussions were promoted in three main locations: (1) SOMINCOR / RTZ, located in Neves Corvo, Alentejo region of Portugal; (2) BOLIDEN / APIRSA, located in Aznalcollar, near Sevilla, Spain, and also (3) Rio Tinto region, located near Huelva, Spain.

Opening remarks / Abstract

The main purpose of this report is to provide some comments on the above mentioned event (organised by UNIDO, CYTED and the Portuguese Ministry of Science & Technology). The main objective of the event was to discuss and present some ideas and possible solutions on the challenges posed upon the mineral extraction industries by considering sustainable development issues. This involved a workshop on sustainable development (its conceptual framework and practices for the mining industry), and discussions on how the sector is managing to promote new behavioural attitudes that are affecting (or will affect) mining decisions, financing of mining projects, territorial management & land use, and a diverse range of issues relating to the social, economical and industrial impacts on environmentally sensitive areas. Contributions by several professionals of different backgrounds were extremely interesting and stimulating. This text produces some general comments on their opinions and theoretical collaboration. My own collaboration was in discussing "*Environmental Management and the Equipment & Technology Market: Business Implications for Mining & Metallurgy in a Globalised and 'Environmentally Problematic' Age*".

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1. Introduction

There is increasing interest within industry in several countries in obtaining greater international acceptance of their business practices and products. This is exemplified by greater interests in developing research and best-practice on what is now known as the 'sustainable development' (SD) field.

New concepts of SD are affecting the mining sector by developing new ideas and tools for *environmental management*. This came as a consequence of more stringent environmental regulation in several countries - this mainly took place from 1992 as a result of the Earth Summit that was held in Rio de Janeiro (Brazil). New laws and regulations were established and the 'protection of the environment' and 'sustainable development' (SD) became more and more a part of the agenda of social, economic and industrial activities. This is continuing to affect businesses as there is a greater need to develop specific 'control instruments and tools' such as Environmental Impact Assessment (EIA) reports, Environmental Licensing (LA), Plans for Recovery of Degraded Areas (PRAD), Life Cycle Assessment (LCA), etc. These are important requirements in order to obtain project approval and licensing for the development of new businesses and industrial activities in most countries of the world today.

One of the main challenges for society nowadays is to define what is 'sustainable development'. This is a challenge for academia, industry and in fact for all stakeholders. It is only with a more precise and detailed definition of SD that we will be able to monitor how industry is affecting the environment, and only in this way we can build the regulatory framework[2] necessary for the enforcement of best-practice and environmentally friendly industrial activities. During the opening of the UNIDO-CYTED event Mr. Luis J. Rodrigues da Costa stated that "Sustainable Development may be defined as the process of economic and ecological management aimed at joint delivery of economic and ecological benefits and services" (citing the European Union Valse Project), and also that "SD means promoting eco-efficiency and developing holistic and integrated approaches such as those that apply the concepts of *life-cycle*" (citing the ideas of the World Business Council for Sustainable Development-WBCSD).

Much more still needs to be undertaken in terms of theory and definitions in order to promote a better relationship between human activities and the environment at large (e.g. industrial practice). Some ideas are provided here in this 'activity report' - although, for a more complete picture of recent research and scholarship in this field, please read the texts listed in the bibliography.

2. The main aims for environmental planning and management

The main aims for promoting Environmental Planning & Management (EPM) are (1) to stimulate action towards environmental protection, (2) to facilitate the reduction of pollution and its implications, (3) to work as an instrument to better regulate the relations between producers, distributors, suppliers, clients and consumers - i.e. all the stakeholders (considering the entire supply-demand chain), and also (4) to promote sustainable development. EPM is applied, in theory, in order to provide known and accepted standards of conduct for industry and, with this, to give a clearer indication to the public in general of what companies can do and what companies are effectively doing to control, reduce and mitigate their impact on the environment (industrial environment included) and on people's lives.

The relevance of EPM to businesses is that it stimulates industry to deal with some important 'management tools' such as: (a) Environmental Management Systems-EMSs (which includes Environmental Auditing-EA, Environmental Impact Assessment-EIA, Life Cycle Assessment-LCA, and Risk Assessment-RA), and (b) ISO standards (which includes a diversity of series for certification and more stringent control of businesses). The development and application of these management tools represent the way forward to promote the sustainable development of the materials industries.

EPM must consider the "three pillars of Sustainable Development", i.e.: environment, competitivity, and social development. In the case of mining in particular, these 3 pillars have to take into consideration: (a) the fact that new mining developments (prospective new mining sites) will require innovation; (b) that current mining activities

[2] e.g. through national and international laws.

(operational mines) will need to adapt; and (c) that old mining sites (closed mines) will require rehabilitation & mitigation. The important words for SD in mining are innovation, adaptation and rehabilitation.

3. The importance of sustainable development

When defining sustainable development in the context of minerals and metals, the best definition seems to be the one given by Natural Resources Canada-NRCAN[3]. It should be recognised that the mining industry is part of a greater picture that deals with several other industries. Economic and social development will only bring benefits in the long-term if current investments and current activities in human and physical capital take into account present and future generations. This means re-enforcing more and more the role and importance of the environmental industries sector.

Professor J. Kahn considered in his presentation that some "clean development mechanism-CDM" must be developed nationally and internationally so that better environmental standards may be acquired for industry and businesses in general (considering control of pollution, emissions, waste management, etc.). The Swedish case was mentioned as one where firms are taxed based on their emission of pollutants. A CDM will require, for example, the establishment of a system of taxation that is to be applied to 'pollution' and to 'materials' (discouraging emissions and encouraging the efficient use of materials and recycling).

Dr. Francisco R. C. Fernandes was very effective in reminding the audience that a great deal of what will happen with the capacity for promoting SD on a global scale will depend on how the "First World" will deal with matters of "mineral resources and international commerce". The inequalities of consumption of minerals in different countries are increasing, and this will require some urgent action, as quality of life, in many cases, depends on the levels of consumption of mineral resources (e.g. for housing, social infrastructure, access to water and sanitation, transportation).

Mr. Gildo Sá Albuquerque went even further by explaining that "the countries of the G-7 have a much higher consumption level of agricultural products (both *per capita* and per square kilometer) than the majority of the other countries of the world". He also considered that "subsidies for agricultural production in the First World are resulting in severe problems for the Third World" (when studying the fertiliser industry and phosphate rock production), and that "it is not sustainable to adopt the consumption patters of the G-7 to the world as a whole".

Other aspects to be considered for developing a sustainable development structure for the mining industry were considered by Mr. José M. Coelho (investment analysis), and Mr. J. A. Espí (territorial analysis). However, what I considered as the most suitable methodology for industrial activities was that of Life Cycle Assessment-LCA (as presented by Dr. Adisa Azapagic). She presented a working framework that was suitable for both - research and practice (concerning industrial activities). Her studies in LCA led to the development of "indicators of sustainable development" considering the relationship between "materials, energy and the environment" on one hand and the "economic system" on the other. The interaction between these two realms provide "goods and services" to society.

Studies in LCA are useful as they consider industrial activities "from cradle to grave" and by undertaking this they provide the best means to understand the effects caused by the production of "functional outputs" (i.e. goods, services, products). LCA studies and methodologies are useful for the promotion of Life Cycle Process Design-LCPD (product design and eco-design) for improving industrial, economic, environmental, technological and social performances. Azapagic op cit cited that there are four main drivers of LCA: legislation, competition, customers and public image; and five barriers for the adoption of LCA: cost & time, methodology, data availability, results, and communication.

Although extremely important and a very interesting methodology, LCA have to be considered within a transparent system of decision-making. Dr. J. Kahn's comments were very pertinent as he reminded us that it is necessary to have "a transparent system of decisions, not a *black box* that spits a decision out without taking into account all the stakeholders (i.e. firm, community, local administration, regional government, national government, global bodies), i.e., a more democratic system of decision-making". The

[3] NRCAN: see internet address given at the end of the text.

contribution by Mr. Stephan Buntenbach and his colleagues from Aachen University was particularly relevant for promoting the "design of an integrated resource management" system that can involve the several types of government and also include corporate governance plans and stakeholder views in a framework where there is a "resource-orientated analysis of raw material flows". An integrated resource-management system for raw materials is to be designed and tested regarding applicability in order to reach the identification of options for resource-sensitive supply and processing of raw materials in "areas of conflict", where the promotion of technical developments have to produce both economical and ecological results.

4. The Technical visits[4]

4.1. Visiting and discussing Sociedade Mineira de Neves-Corvo, S.A. - SOMINCOR

The Neves-Corvo mine near Castro Verde in the Alentejo region of Portugal was shown as presenting a modern and high-standard system of environmental management. SOMINCOR was established on the 24th of July 1980 (as the result of the discovery of ore bodies rich in copper and tin that took place between 1973 and 1977). The project for development & planning for this mine started during the 1981-1983 period. Nowadays they claim to be applying standards for environmental control that are higher than those required by European Union regulations.

One of the main environmental impacts of this mine is that of the discharge of pollutants which affect the local fluvial and water system. The equipment and methodology used today is one that allows for the water of the local river (that receives the polluting emissions) to "regenerate" itself 20 kilometers far from the point of discharge. This is considered to be a good 'regeneration index' by the two main owners of SOMINCOR, the Portuguese Government and Rio Tinto Plc from England.

Most of the equipment (and related technology) used for operating this mine comes from abroad and they include the use of equipment from companies such as ALLIS CHALMERS, ATLAS COPCO, BOLIDEN-ALLIS, Cat (CATERPILLAR), SALA-KREBS, SVEDALA, TAMROCK, VOLVO (and many other multinational suppliers).

[visit to SOMINCOR took place on the 29th of October, 1999].

4.2. Visiting and discussing BOLIDEN-APIRSA

The main reason for visiting Boliden-Apirsa at Aznalcóllar in Spain was to see what is being done in relation to the closure of the tailings pond after the accident which happened during the 24th to 25th of April 1998.

The unfortunate accident seemed to have been triggered as a result of excess material being disposed into the dam without a proper evaluation of the consequences and without a proper environmental impact assessment. It is clear that the engineering of the dam failed to promote a secure environment where building, construction, soil and rock mechanics was concerned.

It seemed that the engineering of the dam did not take into account a proper geological-geothechnical analysis of the region when it commenced construction in 1978, and also later, when the dam was over-loaded. This mistake (or negligence?) caused severe damage to the environment after the 1998 accident.

Even knowing of BOLIDEN's efforts to build a "Strategic Plan for 1999: Boliden Environmental Policy" - that is "committed to: protection of life, health and the environment; an active role in research and development; and to comply with applicable environmental legislation and to exercise good environmental practices" - the reality is that this Swedish-Canadian company with Spanish interests was not effective in avoiding the accident that took place in April 1998 - which led to the contamination of a huge land area (estimated to be around 4200 Ha, including the contamination of rivers, agricultural land and the Doñana National Park).

The main contaminants were As, Pb, Tl and Zn, but the region was also affected by the emission of Ag, Cd, Cu, Hg. These are the "contaminants of concern" for BOLIDEN-

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[4] I would like to remind the reader that the opinions and the perceptions described on these paragraphs dealing with these 'technical visits' were the result of a single day visit and a partial view of the mining activities being carried out in Portugal and Spain. I apologise for any strong views here expressed and would like to mention that more study would be necessary for any final conclusion to be reached.

APIRSA. The level of contamination that affected the area must be cautiously considered, as much seems to be complicated (in terms of pollution levels) by the fact that the sampling of the region began only on August 17, 1998 - a gap of around four months after the accident (which, as already mentioned, took place on the night of the 24th of April).
[visit to Boliden-Apirsa took place on the 2nd of November, 1999].

4.3. Visiting and discussing Minas de Riotinto

The Minas de Riotinto near Huelva in Spain are impressive in terms of history and in affected land area. Although mining in this region predates Roman times, intensive mining started around 1873 with the creation of the English enterprise Rio Tinto Company Limited-RTCL.

Our visit included (a) the Corta Atalaya: the largest open-pit mine in Europe with approximately 1200 x 900 meters wide by 335 meters deep (not currently operational); and (b) Cerro Colorado: also a large mine that is still in operation and extracting an ore type called 'gossan'. The gossan is an iron ore containing gold, silver and copper.

The Minas de Rio Tinto today belongs to the local Labour Society, the "Sociedad Anonima Laboral - S. A. L.". This works as a co-operative of members ("sócios"); the ownership today is in hands of around 400 members and decisions are said to be taken with the participation of the local community.

This mine is extremely interesting from the point of view of reclamation (rehabilitation of the area), as this area has been mined for centuries. Mining took place before any idea of reclamation was developed. The impact caused by mining in this region is very clear - even when only visual perception and visual impact is considered.

The future of the mine depends today on the price of copper not declining even further. The complexity of international copper prices are out of our scope here in this study, but we may say that the future of this Spanish mine is linked with copper mining in Chile (that plans to increase its production and market participation in the near future), with the use of copper for engineering purposes (the main matter here is that copper is being substituted by other materials, e.g. as in the case of optic fiber), on the consumption requirements of some emerging markets (e.g. China), and even on speculative investment funds in the USA.

However, one of the main concerns for the Rio Tinto region is the environmental impact caused by mining. The huge amount of tailings, of waste rock and of disturbed surface area caused by centuries of mineral exploitation is one of the main problems for this region. In terms of "large scale human activities" it is relevant to cite here the contribution given by Mr. Darren A. Swanson in considering the "challenges for technology and policy" in order to deal with "environmental sustainability of mine waste facilities".

The "environmental loading" and "geochemical uncertainty" of mining areas such as the Riotinto region are put into question. Something must be done for the recovery, reclamation and rehabilitation of mining areas, which includes mitigating the negative effects caused by abandoned mine lands.
[visit to the Minas de Riotinto took place on the 3rd of November, 1999].

4.4. Some suggestions for further work & research

(a) Conduct detailed geological and geothecnical surveys prior to the construction of any engineering project.
(b) Accept a single definition for 'Sustainable Development' in the context of mining activities. Some considerations for SD in mining must be taken into account: resource depletion; process & product efficiency; eco-efficiency; recycling; energy consumption; emissions and wastes; employment (work places); standards of living.
(c) Promote more interdisciplinary research in the mining industry.
(d) Work closely with the local community.
(e) Promote greater understanding of mining activities within the European Union and the acceptance of European regulation and legislation.
(f) Analyse other possible competing land uses for the regions where mineral deposits are located.
(g) Accept some basic indices for measuring environmental degradation. For example: establish some index for measuring efficiency of clean-up activities (e.g. US$ per square kilometer affected; US$ per volume of processed material).
(h) Study the pH of soils by comparing current and previous pH levels, and discuss possible effects on the future use of the soil.
(i) Undertake closer water monitoring (for water quality).

(j) Undertake a detailed geological mapping of permeable rocks that serve as aquifers (hydrogeological studies).
(k) Promote further future events such as those organised by the "Jornadas CYTED-XIII" and the "IMAAC Copper Forum".

5. Final remarks

The event was a remarkable mixture of theory and practice via a good combination of presentations of papers and discussions and also mine visits. I consider myself much more knowledgeable with respect to discussions involving issues of sustainable development (more so after having participated in the course-workshops and mine visits). The event involved the participation of professionals from many different countries and with a wide variety of experiences and points of view. This diversity was certainly very interesting for the promotion of a more complete understanding of mining activities and sustainable development issues.

I would like to give many congratulations to the organisers, for UNIDO, CYTED and also to the Portuguese Government, and especially to Professor Roberto C. Villas Bôas for coordinating the event and for supporting all presentations and for providing important comments at the end of each paper.

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(2) http://www.eurogeosurveys.org Geological Electronic Information eXchange System-GEIXS.
(3) http://geomist.igm.pt Geological and Mining Information System on the Iberian Pyrite Belt.
(4) www.igm.pt Instituto Geológico e Mineiro (Portugal).
(5) http://sfb525.rwth-aachen.de/sfb525 Institute of Mining Technology, Aachen University of Technology (Germany).
(6) http://www.icsc.ab.ca/nc2000.htm International Computer Science Conventions Canada / Switzerland.
(7) www.icsg.org International Copper Study Group-ICSG.
(8) http://www.nrcan.gc.ca/mms/sdev/policy-e.htm Minerals and Metals Sector-MMS of Natural Resources Canada-NRCAN (Canada).
(9) www.riotinto.com Rio Tinto PLC (UK).
(10) http://www.unido.org UNIDO.
(11) www.bath.ac.uk/ice University of Bath (UK).
(12) www.wbcsd.ch World Business Council for Sustainable Development (Geneva).

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Informe sobre las Jornadas CYTED XIII y IMACC COPPER FORUM

INTRODUCCION

Las Jornadas CYTED – XIII, se llevaron a cabo en la Facultad de Ingeniería de la Universidad de Oporto en Portugal, entre los días 25 de Octubre al 3 de Noviembre de 1999.

Este encuentro fue organizado por el subprograma de Tecnología Mineral y el International Materials Assessment and Application Center (IMAAC) y estuvo patrocinado por el CYTED, la UNIDO y el Ministerio de Ciencia y Tecnología de la República Portuguesa. La coordinación general la realizó el Prof. Roberto Villas Boas y fue compartida por el Prof. Manuel Fonseca durante las exposiciones realizadas en la ciudad de Oporto.

El objetivo de las jornadas se centró en el problema que causa la explotación, recuperación y refinación de minerales y su incidencia con el medio ambiente, problemática que se abordó desde diferentes puntos de vista. Se tomó como ejemplo a la industria extractiva del cobre y se planteó su incidencia en ambientes sensibles, a los riesgos que representan los residuos ácidos y la toxicidad de los metales para el medio ambiente.

En la segunda parte de las jornadas se visitó las minas de Neves Corvo en Portugal y Aznalcollar y Río Tinto en España.

La Faja pirítica Ibérica.-

En los límites de Portugal y España la F.P.I. está representada por una zona de 230 Km. de largo y 50 Km. de ancho luego continua a través de Chipre, Yugoslavia, Georgia y Armenia. La F.P.I. tiene una extensión general E-O. En la Península Ibérica se conocen más de 100 cuerpos de sulfuros masivos con reservas mayores a los 1000 M.T., según algunos autores inicialmente se depositaron mas de 2000M.T. de sulfuros. Entre los yacimientos más importantes se destacan Riotinto con 500 M.T.; Neves Corvo 250 M.T. Tharsis 120 M.T.; Aznalcollar 90 M.T. En otros países del mundo, el yacimiento más grande de sulfuros masivos está en Canadá (Brunswick) y tiene 134 M.T., de reservas, de lo que se desprende que la F.P.I. es la provincia metalogénica más importante de sulfuros masivos a nivel mundial.

La mineralización en los yacimientos de la F.P.I. está constituida mayormente de pirita con contenidos bajos de calcopiríta, galena y esfalerita. Uno de los problemas que se presentan en el tratamiento de las menas de estos yacimientos es la de que el tamaño de los minerales suele ser muy fino, lo que dificulta en gran medida la obtención de concentrados comerciales de calidad, debido a esto la actividad minera en España y Portugal tradicionalmente se enfocó hacia la pirita, utilizada como mena de azufre para la obtención de ácido sulfúrico, paradójicamente los minerales complejos ricos en metales base, se despreciaban cuando el contenido en pirita era bajo. En la actualidad ocurre lo

contrario pues la explotación de estos yacimientos se orienta a obtener metales base como Cu, Pb, Zn y preciosos como Au y Ag.

En el contexto geológico regional los yacimientos de sulfuros masivos de la F.P:I: están relacionados al llamado "Complejo volcano – sedimentario", el cual está constituido de potentes acumulaciones de rocas volcánicas, originadas en procesos eruptivos intensos ocurridos entre el Devónico superior y el Carbonífero inferior, en todos los yacimientos de la F.P.I. los sulfuros son singenéticos y están relacionados mayormente al volcanismo ácido basal.

El complejo volcano-sedimentario sobreyase al conjunto basal "p – q" que está constituido de una monótona alternancia de pizarras, grauwacas y cuarcitas oscuras; y a su vez está cubierta por el "Culm" que es una monótona alternancia tipo flyschoide constituida de pizarras y grauwacas. En el corte estratigráfico las únicas variaciones de facies , se presentan cuando las areniscas predominan sobre las pizarras o al contrario. El conjunto de rocas que constituye la F.P.I. fueron intensamente deformados durante la orogenia Hercínica, que tuvo lugar en le Paleozoico Superior.

En el recorrido realizado desde la ciudad de Oporto a Castro Verde y luego a Sevilla, las series de rocas que se atraviesan están constituidas mayormente de esquistos, pizarras y grauwacas, pertenecientes al complejo basal "p – q" y al "Culm", los suelos que se han formado como producto de la meteorización de estas rocas son muy pobres y poco permeables, el horizonte A de los suelos que se caracteriza por tener un color negro y ser rico en humus casi no existe; estos suelos generalmente están cubiertos de olivares y sin duda constituyen áreas muy sensibles desde el punto de vista ambiental. De otro lado durante el recorrido realizado fue notorio el cambio que se daba en la morfología del terreno, la calidad de los suelos y el tipo y variedad de cultivos, cuando se atravesaba las cuencas sedimentarias de edad terciaria.

Visita al yacimiento de Neves – Corvo.

El yacimiento de sulfuros masivos de Neves – Corvo es el mas grande depósito cuprífero en producción de Europa y uno de los más importantes de la F.P.I. sus reservas son del orden de 250 M.T., se localiza a 50 Km. Al SO de la ciudad de Beja.

En el área del yacimiento se definen varias intercalaciones de volcanitas ácidas con pizarras negras. Los depósitos de sulfuros masivos están asociados a las volcanitas ácidas y se localizan generalmente en el techo de las mismas, lo que se pudo observar en el recorrido realizado dentro de la mina.

En el yacimiento se diferencian cuatro tipos de menas: sulfuros masivos, stockwork, brechas y rubané. La mineralización rubané está constituida de cobre y estaño y es única dentro de la F.P.I se localiza en el techo de los sulfuros masivos de la masa Corvo.

El complejo minero –industrial de Neves – Corvo, está localizado en una área ambientalmente muy sensible por lo que las compañías R.T.Z. y SOMICOR que

operan en la mina, promueven el desarrollo sustentable, mediante el cumplimiento de las normas y procesos que establece el Reglamento minero lo que permite prevenir, controlar, mitigar y rehabilitar los efectos que las actividades mineras tienen sobre el medio ambiente y la sociedad.

Visita al yacimiento de Aznalcollar.-

Se localiza a 25 Km. Al oeste de Sevilla, en el extremo SO de la F.P.I. , el yacimiento presenta una morfología orientada en sentido E-O al igual que la mayoría de los yacimientos de sulfuros masivos de la F.P.I. , así mismo los cuerpos de sulfuros están concordantes con las rocas encajantes y localizados en el techo de una secuencia piroclástica ácida perteneciente como en la mayoría de los yacimientos al primer evento volcánico. De los 4 cuerpos mineralizados que existen en la zona, dos han sido descubiertos con las cortas de Aznalcollar y los Frailes, lo que evidencia la existencia de dos cuerpos mineralizados de grandes dimensiones 700 x 300 m y una potencia de hasta 100m.

Antes de recorrer la zona, el personal técnico de la Compañía BOLIDEN – APIRSA, en forma amplia, clara y documentada nos expuso aspectos relacionados a la génesis del yacimiento, forma y disposición de los cuerpos de sulfuros masivos en el espacio, métodos de exploración y explotación. La mineralización en Aznalcollar es compleja y está constituida de pirita, esfalerita, galena, calcopirita y sulfosales de Fe, Cu, Pb y Ag de estructura bandeada y grano muy fino, lo que dificulta la recuperación de los metales.

En forma amplia se nos expuso el problema que causó el rompimiento de la presa de colas de Aznalcollar, como consecuencia de lo cual decenas de miles de toneladas de material en forma de lodos, suspensión y disolución fueron arrastrados a lo largo del cause del pequeño río que atraviesa la zona, llegando el material mas fino y disuelto incluso al Océano Atlántico . Sin embargo lo más impresionante fue conocer que en pocos meses con un despliegue de hasta 500 volquetas operando simultáneamente se logró limpiar la zona. En la actualidad la empresa se encuentra relimpiando otra vez la zona.

La presa se localiza en lugar ambientalmente muy sensible, los materiales transportados constituidos de sulfatos, arceniuros, antimoniuros de Cu, Pb, Zn, Ag, así como de cianuro y mercurio pudieron haber causado un impacto de impredecibles consecuencias en la zona, sin embargo, como ya se anotó , la actuación rápida con un despliegue de maquinaria nunca visto en casos similares evitó en gran medida consecuencias más graves.

Visita al distrito minero de Ríotinto.-

Ríotinto, está situado a 70 Km de la ciudad de Huelva y 90 Km de Sevilla.

Ríotinto, es el yacimiento de sulfuros masivos volcanogénicos (SMV) más grande del mundo. En el corte del Cerro Colorado, así como en la corta Atalaya, localizada en el flanco Sur del anticlinal de Ríotinto, se ve aflorar a la superficie

el clásico modelo de este tipo de yacimientos, que ha servido de base para la búsqueda y exploración de SMV en todo el mundo.

En el núcleo del anticlinal afloran rocas volcánicas de composición media a ácida, las cuales están atravesadas por un sistema de vetas y vetillas tipo stockwork, que constituyeron los canales por donde subieron las soluciones hidrotermales que formaron los SMV, en los flancos sur y norte del anticlinal se localizan los enormes cuerpos de SMV constituidos mayormente de pirita, en la parte superior sobre la superficie erocionada del anticlinal se forma un enorme gossan con contenidos importantes de Au y Ag., en la base del cual se localiza una capa de 30m de potencia, que constituye la zona de sedimentación o de enriquecimiento secundario de sulfuros con altos contenidos de Cu, Ag y Au.

En la Revista Bocamina de España, al referirse al Ríotinto, se dice: "Hace miles de años el hombre horadó el suelo del Ríotinto buscando metales para la fabricación de utensillos básicos. El paso de los siglos ha revelado el suroeste ibérico como una de las zonas del planeta con mayores acumulaciones metálicas. Decenas de labores mineras atestiguan la categoría geológica y económica de sus yacimientos". En Ríotinto en grandes volúmenes se explotó inicialmente los cuerpos de sulfuros masivos; constituidos básicamente de pirita, materia prima para producir ácido sulfúrico, luego se explotó el stockwork y la zona de enriquecimiento secundario de sulfuros, rica en Cu, Ag, y Au; cuando subió el precio del oro en los años 80, se inicio la explotación del gossan, cuyas reservas alcanzaron 500MT, con 1.5 Grs/ton de oro, en la actualidad se están explotando los materiales de las escombreras y colas residuo de antiguas explotaciones.

Los problemas medio ambientales que se han presentado como producto de las operaciones minero-extractivas y de recuperación, en forma sistemática y planificada han sido y siguen siendo resueltas por la compañía que opera en la mina.

Yacimientos de sulfuros masivos en el Ecuador:

En el Ecuador existen dos pequeños yacimientos de SMV, Macuchi y La Plata, los cuales fueron explotados por la South American Development Company SADCO, en la década de los 40. Los yacimientos del distrito de Macuchi, están localizados en el flanco Occidental de la Cordillera Occidental de los Andes Ecuatorianos y están relacionados a un complejo de rocas volcánicas ofiolíticas. Los cuerpos de sulfuros masivos son pequeños (o,5 MT) sin embargo tienen altos contenidos de metales: oro 11 grs, Cu 4.7%, Ag 68 grs por tonelada, en el yacimiento La Plata según datos de archivo algunos bloques contenían hasta 150grs/ton de Au.

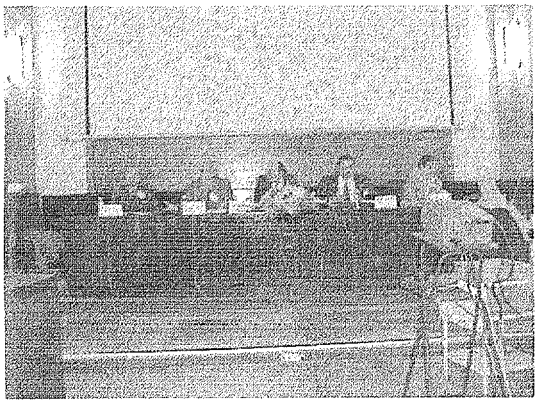
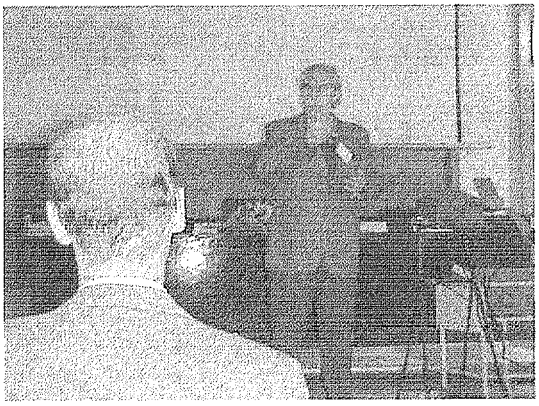
Como producto de la explotación irracional de estos yacimientos, grandes colas de materiales se ven a orillas del Río Macuchi, los cuales producen elementos tóxicos y residuos ácidos que son acarreados por el Río y contaminan el medio ambiente. Luego de las jornadas de Oporto, esperamos una vez más hacer

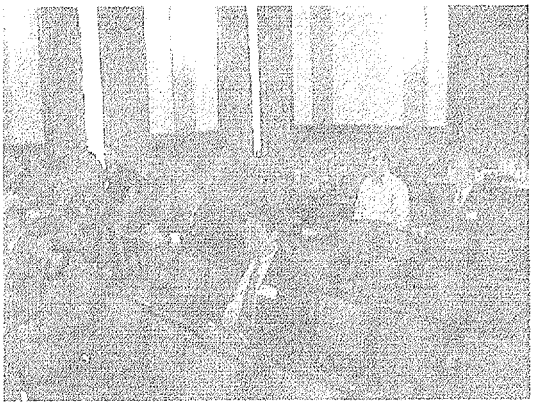
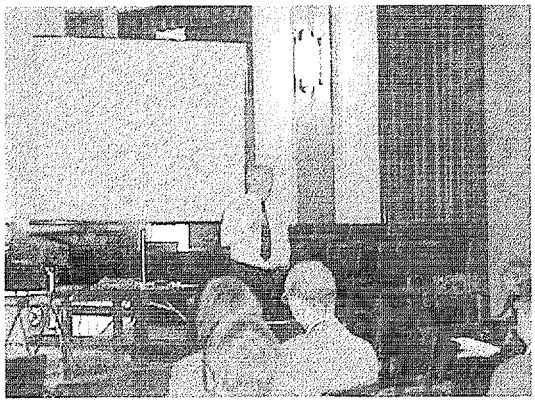
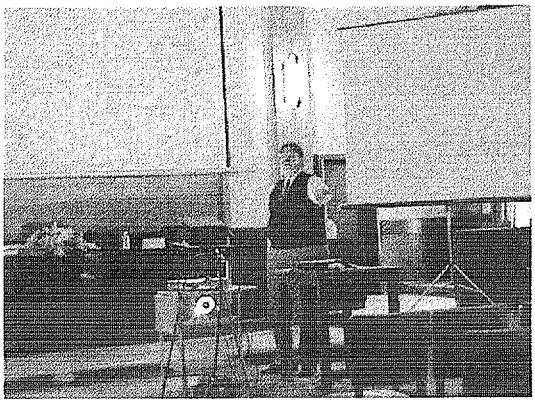
conocer este problema a las autoridades del ramo, para que solucionen el problema.

Agustín Paladines

ANNEX THREE

PHOTOS

Photos 1, 2, 3, 4, 5 and 6 ≡ Some aspects at room sessions

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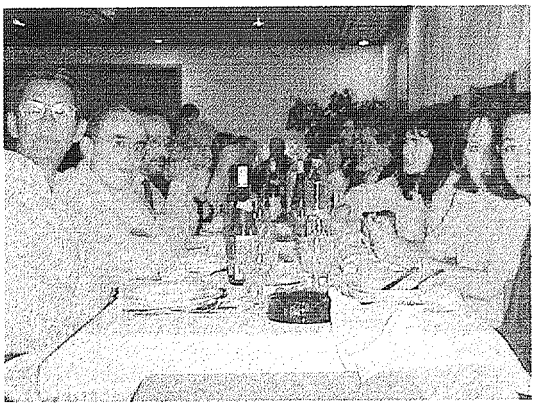
3	4
4	5



1	2
3	4
5	6

Photos 1, 2, 3 ≡ Port Wine Caves visit

Photos 4, 5 ≡ Dinners

Photo 6 – Some of the attendants at Neves Corvo

ANNEX FOUR

ADDITIONAL DOCUMENTS

A Specialised Agency of the United Nations dedicated to promoting sustainable industrial development in countries with developing and transition economies.

UNIDO INTERNATIONAL TECHNOLOGY CENTRES

(ITCs)

1999

CONTENTS

7. INTERNATIONAL TECHNOLOGY CENTRES

I. Technology and Investment in the New Global Economic Context

The rapid economic growth worldwide has been achieved by countries which have adopted technology as the engine of growth. Furthermore, the new context of globalization, free trade agreements, deregulation and other factors is critically enhancing the role placed by technological innovations in both economic growth and the competitiveness of business.

Taking into account the new global competitive environment, top management of the technology-based companies regards technological leadership today as a key prerequisite for the companies' success and growth. In the future, competitive pressure on firms is expected even to increase as a result of growing competition in the world markets and in the context of GATT commitments.

Therefore, technological innovation and new technologies are now at the core of the strategies of successful industrial firms of any size in any country. But the technology transfer process and application of new technologies at the industrial scale go alongside with industrial investment which, in particular private investment, is a key determinant of economic development and employment creation.

Today, the establishment of a conducive investment climate for promotion of innovations, the generation of matching national investments and the improving the institutional capacity constituting the infrastructure and business environment for the absorption and utilization of technology and investment in industry are clearly seen as a key requirement for industrial competitiveness. But there is a need for an integrated wide-ranging investment and technology promotion approach that would not only attract and retain the inflows of investment and technology but will also make the optimum use of them for the domestic economy.

II. Establishment and Networking of UNIDO International Technology Centres

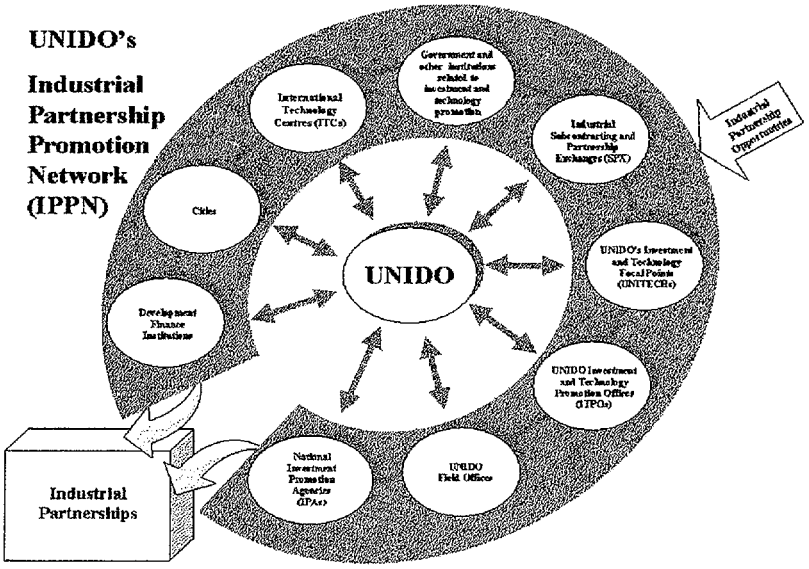
With globalization and increase in the international competition, technological advances have been recognized as a key issue for sustainable industrial development in developing countries. Since the 1980s, UNIDO has been repeatedly called upon by its governing bodies to accelerate international cooperation in the technological area, including the establishment of international technology centres and networks.

UNIDO has responded to these demands and specific requests of both industrialized and developing countries and developed a substantial programme to support the establishment and operation of a number of centres in various technological areas. The programme on Centres is derived from and underpinned with information and analysis from UNIDO's ongoing regular programmes.

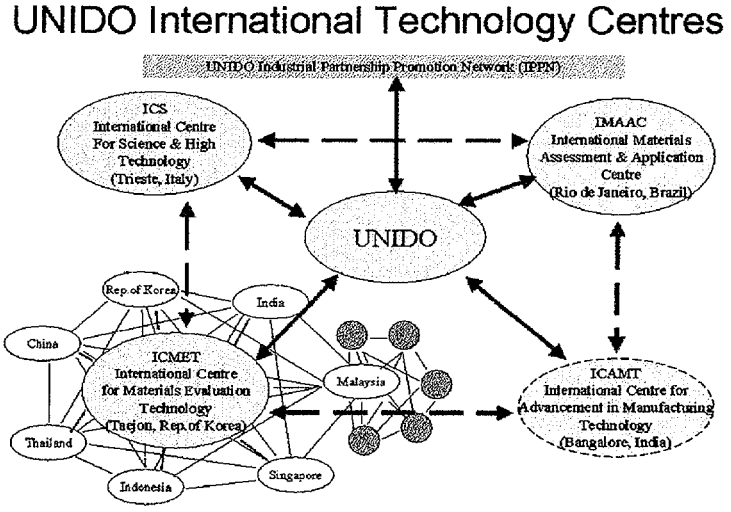
The ITCs provide UNIDO with visibility in specific technology areas and have now become a UNIDO trademark since the Organization is recognized as the only UN agency having this unique tool for promotion of international collaboration and encouraging industrial investments in the area of new technologies.

The Centres, being fully financed from extra-budgetary contributions, play an important complementary role to UNIDO programme of work in the various technology areas. Each International Centre has an active network consisting of industrial R&D institutes, universities, professional and industrial associations working in the same subject area and having their own networks of partners with strong links to industry. These surrounding the Centres networks provide the opportunity to ensure that the work programmes of ITCs continuously reflect the industrial needs of the countries.

To better integrate the services of the Technology Institutes with the other partners involved in the national industrial development UNIDO has developed a unique **Industrial Partnership Promotion Network (IPPN) which brings together government organizations, public and private industries, R&D institutes, technology centres, universities, funding institutions and investment.**

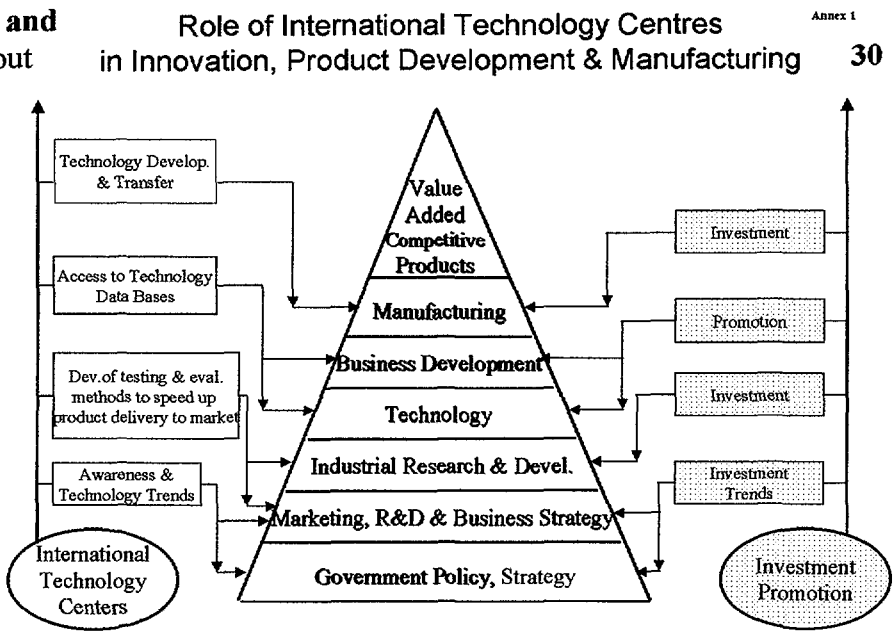


Within this international network and the new context of international competitiveness, **the UNIDO International Centres and their sub-networks** consisting of research and technology institutes, both operational and under establishment, form a relevant source of knowledge and technology resource. They provide a mechanism for building up awareness on technological advances and innovations and are effective instruments for providing decision-makers in developing countries with up-dated information on technology and investment trends.



It is also important to note that support and finance for UNIDO Technology Centres comes from extra-budgetary contributions of a wide range of countries, both developed and developing. An interesting new aspect is the interest from existing international centres of excellence and other international organizations to join and collaborate with UNIDO International Technology Centres (e.g. ICMET established cooperative links with VAMAS - similar cooperative programme of the G-7 countries). In addition, some leading industrial groups expressed the interest in establishing international cooperation with UNIDO Centres as well.

Today more than **40 Research and Technology Institutes** and about **Universities** are key elements and active counterparts of the **UNIDO International Technology Centres**. Through them, and as illustrated in the diagram, UNIDO helps industry to develop technology strategies, build up indigenous capacity to absorb innovations and attract investments and promote and facilitate new partnership worldwide.



1. INTERNATIONAL CENTRE FOR SCIENCE AND HIGH TECHNOLOGY (ICS), Trieste, Italy

A UNIDO autonomous institution whose action - is concentrating on its specificity with an annual budget of approximately US$4,5 Million (Trust Fund). The areas of competence mandated to ICS are covering a wide spectrum of new technologies, particularly:

- pure and applied chemistry;
- earth environment and marine sciences and technologies;
- high technology and new materials;
- institutional, management, interdisciplinary and networking activities.

The main activities of ICS aim at building up national capacity in technology promotion, commercialization, transfer and management and include:

- expert group meetings, seminars and workshops on technology development and commercialization issues;
- training courses on technology management and strategic business alliances;
- study tours and fellowships;
- short-term consultancy

services;
- monitoring technological advances and dissemination of information through publications;
- establishing and strengthening the links between the research community and industry;
- networking.

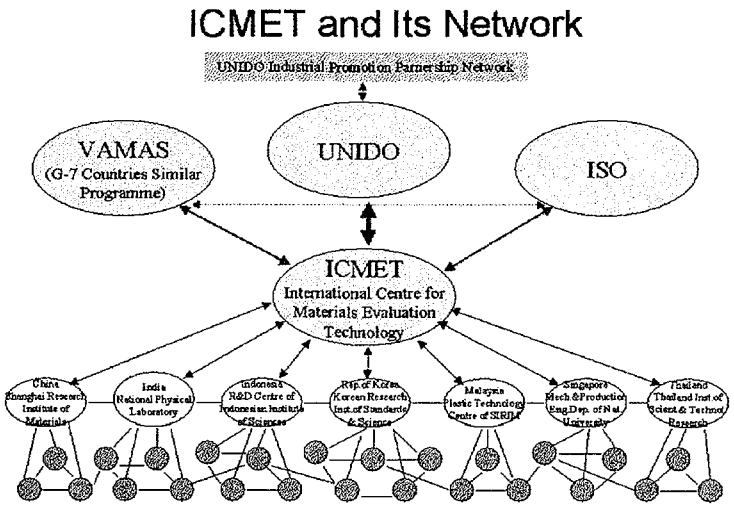
At present, UNIDO and ICS are reviewing the strategy in terms of strengthening the role of the Centre in promotion of technological advances and innovations to encourage new industrial investments, harmonizing its programmes in the transfer of know-how and technology within the frame of other UNIDO International Technology Centres. ICS is active in building up technological capacity in the developing countries taking into account the new Service Modules of UNIDO and global economic and competitive environment.

2. INTERNATIONAL CENTRE FOR MATERIALS EVALUATION TECHNOLOGY (ICMET), Taejon, the Republic of Korea

At present, UNIDO is implementing the "Pilot and Preparatory Phase for the Establishment of an International Centre for Materials Evaluation Technology (ICMET)" project with initial budget of US$300,000 (Trust Fund). It focuses mainly on capacity-building activities through training and carrying out collaborative programmes to harmonize testing and evaluation methodologies in selected areas of new materials. In the context of new Service Modules of UNIDO, it develops the strategy for its further promotion and establishment.

The main aim of the project in 1999 is to develop a new strategy taking into account the rapidly changing economic environment, to harmonize the activities of ICMET and its network with other UNIDO International Technology Centres and programmes in investment promotion area. It is also planned to develop a new work programme and to continue carrying out the activities to mobilize additional funds for ICMET operational phase.

The mission of ICMET and its network is to develop international guidelines, codes of practice, and standards on testing and characterization of new materials, which can be accepted across national boundaries. The development, verification and application of common (for both producers and users) methodologies for materials testing and evaluation speed up the application of new materials at the market place and promote further development of new products and processes, thus encouraging new industrial investment.



Thus the main role of ICMET is to bridge the gap between research and development organizations, innovative enterprises and the market place in the developing countries in order to stimulate the diffusion of new materials and processing technologies and their application in materials related sectors of industry. ICMET is also to bridge the gap and foster the collaboration

and partnerships between developed and developing countries in this vital for industrial development area.

At present, ICMET has already established links with VAMAS Programme (similar G-7 countries' collaborative programme to which the developing countries have received now the access via ICMET). ISO has also expressed the interest to cooperate with ICMET and to work out a relevant agreement on this matter. The year 1999 will be the year of consolidation and strengthening of these cooperative relations. It is also planned to expand the activities to other regions and further develop the ICMET network.

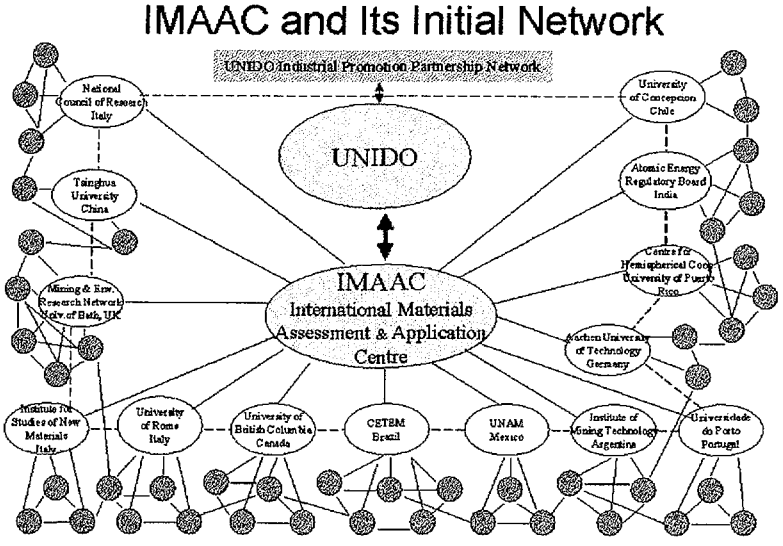
3. INTERNATIONAL MATERIALS ASSESSMENT AND APPLICATION CENTRE (IMAAC), Rio de Janeiro, Brazil

IMAAC started its Pilot Activities Phase in May 1998 with the initial budget of US$140,000 (Trust Fund), which expected to be increased this year. IMAAC has already established an initial network consisting of more than 60 R&D and technology centres, universities and national authorities dealing with different materials related issues in 12 countries (Argentina, Brazil, Canada, Chile, China, Germany, India, Italy, Mexico, Portugal, Puerto Rica, and United Kingdom).

The mission of IMAAC is to provide an international forum to serve the materials community for more effective management and utilization of traditional as well as new materials taking into account their techno-economic aspects and impact on sustainable industrial development. It will function as a proactive institution in building up awareness in industries and governments in the face of technology trends having an impact on development of national materials and human resources within the rapidly changing global economic environment.

Based on that, IMAAC will assist developing economies to absorb and apply rapidly emerging knowledge of materials and to enable them to cope with the demands of competitive global markets as well as meeting quality and environmental standards. It will also help the entrepreneurs and investors to look for new businesses and partnerships.

In 1999, IMAAC and its network is focusing on further promotion, development of its network, harmonization of the work programme with other UNIDO International Technology Centres and Service Modules, especially in the area of investment and technology promotion, and on developing the strategy for the years to come. The "Materials Forum '99" conducted by UNIDO/IMAAC within the framework of the International Conference and Exhibition, which was organized by the International Union of Materials Research



Societies in June 1999 in China, demonstrated a high interest of other materials institutions to work within the frame of IMAAC work programme. This forum is seen as a good platform to promote IMAAC and other International Technology Centres as well as new UNIDO Service Modules.

4. INTERNATIONAL CENTRE FOR ADVANCEMENT OF MANUFACTURING TECHNOLOGY (ICAMT), Bangalore, India

The Pilot Activity Phase of ICAMT started on 1 October 1999 with the budget of US$1,4 million for the two-year work programme. Additional US$1,3 million are to be mobilized to fully implement the Pilot Phase and develop a work programme for the next Operational Phase of ICAMT. The main aim of ICAMT will be to enhance technological performance in manufacturing, productivity, and quality of goods and competitiveness of developing countries through the transfer of advances in manufacturing technologies and techniques.

The centre will provide a wide range of services including individual project engineering, training courses, demonstrations, and assistance in selecting and using technologies, software and equipment. The establishment of ICAMT will help develop a strategy and policy and encourage new investments into manufacturing industry, promote the creation of joint ventures, South-South and North-South cooperation, and facilitate the building up business partnerships.

ICAMT will provide small manufacturers with an extensive selection of state-of-the-art systems with which they can gain hands-on experience and allows them to make intelligent decisions on the system selection that it best suited for their application. It will also act as the UNIDO resource base in manufacturing technologies and as a partner of UNIDO sub-regional, field and Investment Promotion Services Offices, as well as other members of its partnerships' network. The network of ICAMT is under establishment.

5. INTERNATIONAL CENTRE FOR APPLICATION OF SOLAR ENERGY (CASE), Perth, Western Australia

A UNIDO Centre working in the area of commercialization of new energy technologies, particularly solar photovoltaics. CASE operates with a Trust Fund of AUS$1,0 million.

6. INTERNATIONAL CENTRE FOR SMALL HYDRO POWER (IN-SHP), Hangzhou, People's Republic of China

UNIDO was instrumental in transforming the Asian-Pacific regional centre to an international one. It runs an extensive promotional and training programme, including the transfer of technologies. In 1998, the Government of the People's Republic of China provided the IN-SHP with the new building as of value of US$20,000.

7. INTERNATIONAL CENTRE FOR HYDROGEN ENERGY TECHNOLOGY (ICHET), Istanbul, Turkey

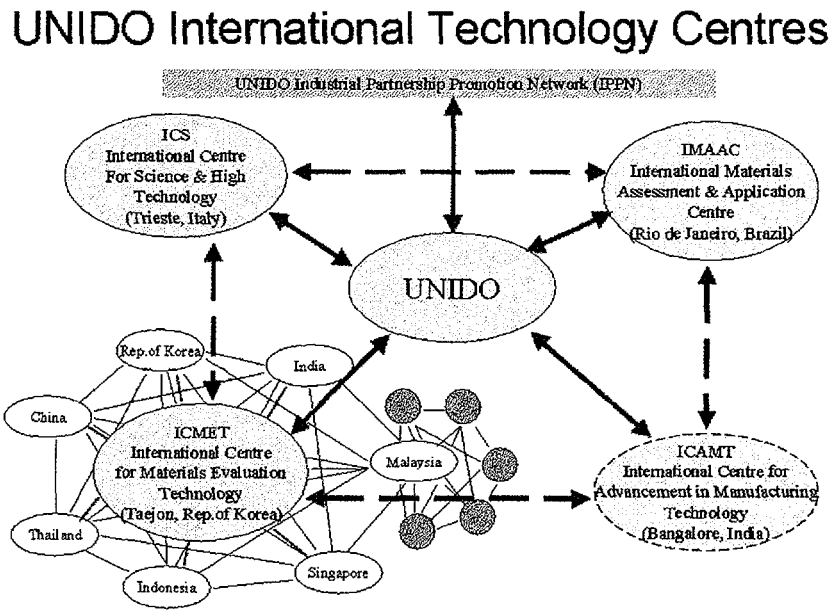
ICHET is currently under promotion with an estimated budget of US$40,0 million for the first 5 years.

UNIDO Programme to Build up Strategic Partnership Bridging Research with Industry

With globalization and increase in the international competition, technological advances have been recognized as a key issue for sustainable industrial development in developing countries. Since the 1980s, UNIDO has been repeatedly called upon by its governing bodies to accelerate international cooperation in the technological area, including the establishment of international technology centres and networks.

UNIDO has responded to these demands and specific requests of both industrialized and developing countries and developed a substantial programme to support the establishment and operation of a number of centres in various technological areas. The programme on International Technology Centres (ITCs) is derived from and underpinned with information and analysis from UNIDO's ongoing regular programmes.

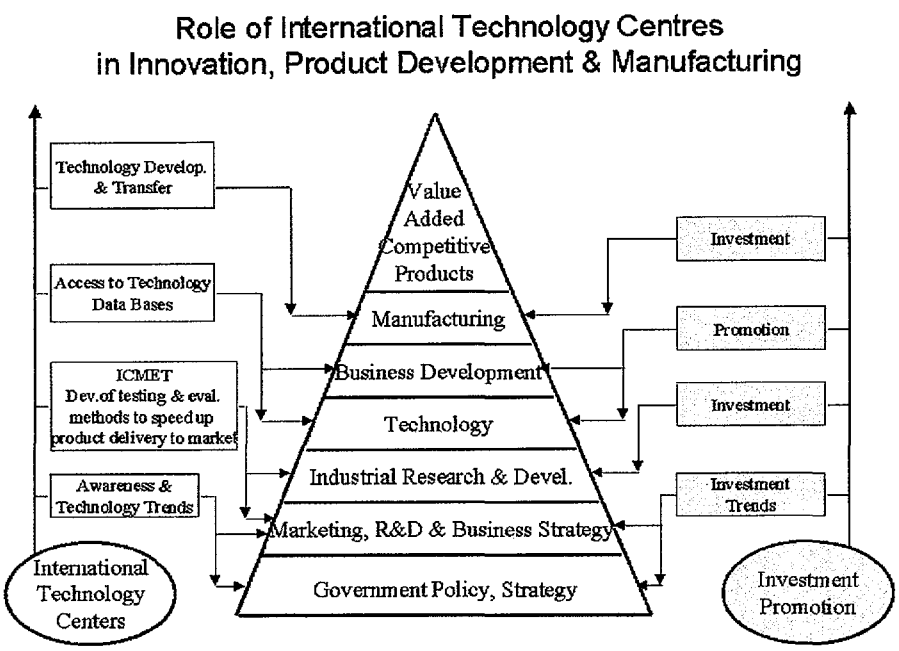
Each International Centre has a network consisting of industrial R&D institutes, technology centres, universities, which are linked to professional associations and industry working in the same subject area and having their own networks of partners. The industrial surrounding of the Centres and their networks provide the opportunity to ensure that the work programmes of ITCs continuously reflect the industrial needs of the countries. In this diagram, you can only see the Centres dealing with different issues of materials and processing technologies.



Within the new context of international competitiveness, the International Technology Centres and their networks have, in addition, become an important worldwide knowledge and technology resource and act as a bridge between the research community and industry supporting the process of commercialization of research results at the industrial scale.

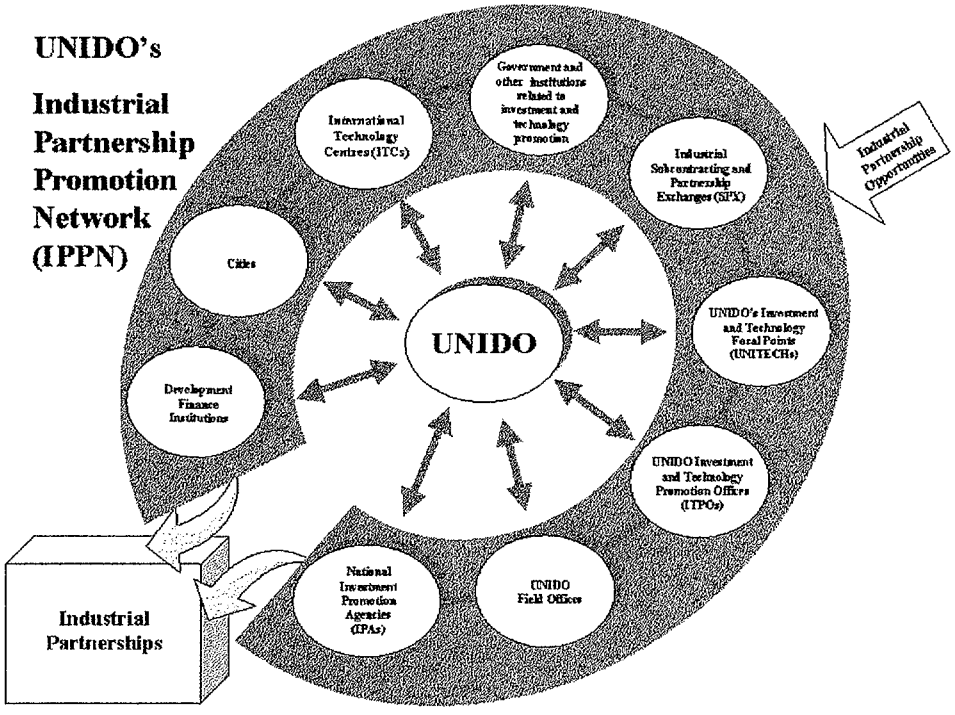
Today more than 40 Research and Technology Institutes and about 30 Universities are key elements and active counterparts of the 9 UNIDO International Technology Centres, of both established and being established. Through them, and as illustrated in the diagram, UNIDO helps industry develop technology strategies, build up indigenous capacity to absorb innovations, encourage and attract investments, and promote and facilitate new partnership worldwide.

The Centres provide a mechanism for building up awareness on technological advances and innovations, linking the technology promotion with new investment opportunities, assisting in creation of new industries through international collaboration, business partnerships and strategic alliances. They also act as the bridge for cooperation between developing countries themselves and between them and industrialized countries.



To better integrate the services of the Technology Institutes with other agents of a National Innovation System and partners involved in the national industrial development, UNIDO has developed a unique Industrial Partnership Promotion Network (IPPN). It brings together government organizations, public and private industries, R&D institutes, technology centres, universities, funding institutions and investment agencies worldwide.

Within this international network, UNIDO International Technology Centres and their sub-networks, both operational and under establishment, play an important role of a substantive knowledge and technology resource. They also provide a mechanism to build up awareness on technological advances and innovations and are effective instruments for providing decision-makers in developing countries with up-dated information on technology and investment trends taking into account the global and country's specific contexts.



The ITCs provide UNIDO with visibility in specific technology areas and have now become a UNIDO trademark since the Organization is recognized as the only UN agency having this

unique tool for promotion of international collaboration and encouraging industrial investments in the area of new technologies. It is also important to note that support and finance for UNIDO Technology Centres comes from extra-budgetary contributions of a wide range of countries, both developed and developing. They play an important complementary role to UNIDO work programme in the various technology areas. In fact, the UNIDO programme draws support from the centres and, therefore to some extent, they are providing additional resources to programmes under the UNIDO regular budget.

As a very important example is the International Centre for Science and High Technology (ICS) in Trieste, Italy. It is an operational Centre with an annual budget of approximately US$4,5 Million. The areas of competence mandated to ICS are covering a wide spectrum of new technologies in the areas of chemistry, environment and high-tech. In addition, the Centre is carrying out, in very close cooperation with UNIDO, a number of initiatives related to, Technology Management, Strategic Business Alliances, Industrial Competitiveness, Demand Survey and Technology Foresight. Furthermore, ICS can provide expertise in specific information applications like process simulation, decision support systems, geographical information and expert systems. These are tools indispensable and very effective for an in-depth analysis of the data collected in technology areas.

The International Materials Assessment and Application Centre (IMAAC) is being established in Rio de Janeiro, by UNIDO in cooperation with the Ministry of Science and Technology of Brazil. The Centre will provide an international forum to tackle more effective management and utilization of materials resources. It will also assist developing economies to monitor innovations on materials through its established network of more than 60 institutions dealing with different issues in the materials cycle i.e. development, production, re-cycling, etc.

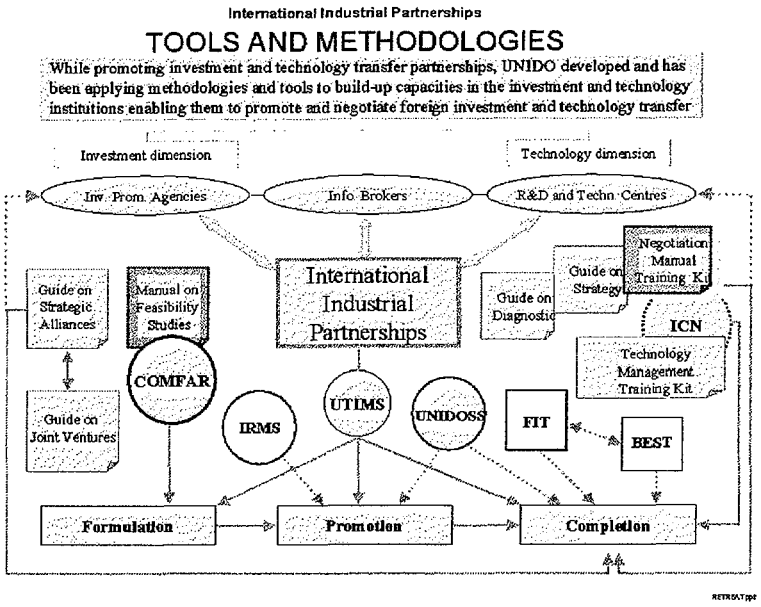
The mission of the International Centre for Materials Evaluation Technology (ICMET), which is being established in Taejon, the Republic of Korea, is to develop international guidelines, codes of practice, and standards on testing and characterization of new materials, which can be accepted across national boundaries. The development, verification and application of common (for both producers and users) methodologies for materials testing and evaluation will speed up the application of new materials at the market place and promote further development of new products and processes, thus encouraging new industrial investment.

The International Centre for Advancement of Manufacturing Technology (ICAMT) will start its pilot activity phase in October 1999. Its main aim will be to enhance technological performance in manufacturing, productivity, and quality of goods and competitiveness of developing countries through the transfer of advances in manufacturing technologies and techniques. ICAMT will provide small manufacturers with an extensive selection of state-of-the-art systems with which they can gain hands-on experience and allows them to make intelligent decisions on the system selection that would best suite for their application.

Further to its experience and international contacts and networks, UNIDO has also **specific tools and methodologies related to the technology and investment promotion** cycle, which among others, cover the following aspects:

- **Assessment** of the competitive position of enterprises, their **critical technology needs** and innovative capacity.

- Assessment and development of **technology strategy** and **technology management** at the enterprise level.
- Country's promotional strategy including the **design of legal and policy instruments.**
- Building up the **portfolio of business opportunities**.



In that connection, UNIDO has developed guides, manuals training kits and software packages which cover the range of issues which are relevant for the implementation the technology and investment operations, and addressing the capacity building needs of the various types of institutions concerned. These instruments are shown in the above diagram.

Additionally, **UNIDO can bring into play its range of services**, specialized competencies and longtime experience of its core services in areas ranging from **industrial policy advice to investment and technology promotion, from quality management to energy efficiency and cleaner production, from small- and medium-scale entrepreneurship development to statistics and information networks**.

Considering all the above, it becomes clear that **UNIDO programme on strategic partnership between research and industry together with the IPPN constitute a solid base and mechanism for promotion of innovations** being able to provide reliable and updated information on country needs, technological trends, sectoral research, development capacities, expertise available and investment opportunities.

Additional information on other UNIDO programmes and services can be obtained from the UNIDO Home page at Internet (http://www.unido.org).

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International Materials

Assessment and Application Centre (IMAAC)

Rio de Janeiro, Brazil

Materials technology is a key enabling technology for a wide range of industrial sectors, which will have a major influence on the economic and industrial competitiveness. New and advanced materials constitute one of the key trends in the technology of engineering industries, leading to major qualitative changes in the production cycle – from processing of raw materials to obtaining of finished products.

In future, both the new materials and the ones with improved properties, will play an essential role in the development of advanced technologies such as electronics, mechatronics, new energy, aerospace, etc. In addition, the technological impact of new materials on related industries will be very significant and this is a more important point than the market size of new materials itself.

As part of the definition phase in the establishment of IMAAC, a UNIDO mission of experts, who already possessed considerable knowledge and information regarding the needs and circumstances of developing economies in the materials field, visited selected institutions in both industrialized and developing countries. The mission met with the great deal of positive response both at the individual and industrial levels.

The urgent needs for establishment the Centre was recognized and both the concept and broad aims and functions to be performed by IMAAC received endorsement. The Government of Brazil expressed its strong interest in establishing and hosting IMAAC and provided an initial fund to start a Pilot and Preparatory Phase for its establishment (1998-2000).

MISSION

- To provide an international forum to serve the materials community for more effective management of the techno-economic aspects of sustainable development and utilization of traditional as well as new materials.
- To function as a proactive institution in building up awareness in industries and governments in the face of technology trends having an impact on national materials resources.
- To assist developing economies to absorb and apply rapidly emerging knowledge of materials and to enable them to cope with he demands of competitive global markets as well as meeting quality and environmental standards.

OBJECTIVES

The core objectives of IMAAC are:

- To address materials issues in changing economic ad environmental contexts to foster sustainable development.
- To assist in the formulation of policies and approaches for optimal and effective use of materials resources.
- To strengthen industrial systems in the assessment, choice, pricing and acquisition of available and new materials technologies.
- To promote innovations in materials and product design as well as management of processing issues for achieving value addition to materials resources.

FUNCTIONS

The extensive programme of global activity will be specifically focused on accelerating the development and application of materials technologies. The programme will focus on the following main areas of work:

- To develop and manage a materials information system including quality norms and environmental standards.
- To review and assess developments and applications in the field of materials as required.
- To create an awareness service to provide information on technologies and opportunities in materials.
- To establish Internet collaborative projects with institutions of known competencies to serve the objectives of the Centre.
- To promote international joint projects and partnerships with reference to identified objectives.
- To organize IMAAC annual forums and training programmes in selected materials areas.

BENEFITS FROM PARTICIPATION

The programme will be tailored to meet the needs of participating countries, industrial and professional associations, institutions and organizations. IMAAC will provide industry with an extensive selection of state-of-the-art technologies with which they can gain hands-on experience and make intelligent decisions that would best suit for their needs. The judgment of benefit from the individual programmes and projects that IMAAC will initiate depends, at a detailed level, on precise inputs and outputs. At a general level, ***the overall benefits will be:***

- Membership in the new UNIDO Industrial Partnership Promotion Network that operate within the framework of the Investment and Technology Promotion programme.
- Access to an international initiative dedicated to meeting the materials industry needs of the developing world.
- Cost effective, low risk involvement.
- Opportunities for new industrial business partners and contracts.
- Direct access to a dedicated resource team of practicing experts in the area of materials technologies.
- Tailored projects to augment their own national initiatives brining wider scope, inputs and benefits.
- Access to the latest technologies and techniques through network agreements undertaken by IMAAC with developed country institutes and experts.
- Knowledge and benchmarking data derived directly from customized projects.

Taking into account the above mentioned, you are kindly invited to participate in the work programme of the International Materials Assessment and Application Centre and to identify operational links with this Centre. We would highly appreciate receiving from you any comments, suggestions, specific project recommendations, etc. Additional information on other UNIDO programmes and services can be obtained from the UNIDO Homepage at Internet (http://www.unido.org).

FUNDING ARRANGEMENTS

The international dimension of the designed Centre and the need for its efficient management and innovative methods of work require a kind of pump priming fund which will help the nucleus to grow to a stable size and demonstrate the value of such a cooperative programme. Once this is achieved, the Centre should be expected to raise sufficient additional amounts from other sources for carrying out its activities.

The Government of Brazil expressed its interest in hosting the Centre and made the decision to allocate initial funding to start the project. Funds for the Centre's programmes are currently being sought from a range of organizations. These include: international aid and development funding organizations, national government development programmes, non-governmental aid organizations, organizations sponsoring research, private industry, and industrial organizations.

IMAAC provides a unique opportunity for funding organizations to 'leverage' scarce financial resources. Funding organizations can direct funds towards specific programmes. This ensures that a high ratio of programme funds is effectively applied for maximum benefits of the target communities. Appropriate management procedures ensure a high level of financial accountability.

The Centre also seeks to consolidate funds from a variety of sources to undertake programmes for the benefit of developing countries.

INVITATION TO PARTICIPATE

Opportunities now exist, at a number of levels, for participation in the realization of the IMAAC concept.

I. Government organizations, R&D centres and enterprises from both public and private sectors of industry, and funding agencies active in materials design, development, production and application, are invited to submit project proposals and suggestions for areas of cooperation.

II. Research, manufacturing, marketing, financing, aid and policy development organizations and trade organizations are invited to make general operational suggestions and specific project recommendations. Discussions focused on identifying joint project opportunities involving the IMAAC are also welcome.

III. Relevant international organizations are invited to seek formal links with IMAAC. In this manner, as the proposal develops, their participation can be considered from the start.

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Annex A-2

International Centre

for Advancement of Manufacturing Technology (ICAMT)

Bangalore, India

As part of the feasibility study, UNIDO team of experts visited a number of countries that had taken particular interest in the establishment of such a centre, namely: Australia, Belgium, Brazil, Egypt, India, Malaysia, Mexico, the Netherlands, the Philippines, the Republic of Korea, and the United Kingdom. During the visits, UNIDO mission received strong expression of future support to ICAMT and desire for active involvement and cooperation at all stages of the project.

Since that time, UNIDO has continued to promote the concept of ICAMT and to negotiate the funding arrangements for the Centre at its initial stage of operation with the Government of India. India has expressed the interest in hosting ICAMT and to provide the substantive part of funding through the Trust Fund Agreement with UNIDO. ICAMT plans to start its Pilot Activity Phase from 1 October 1999 and implement it in two years by 30 September 2001. The second Operational Phase will start from 1 October 2001.

MISSION

The mission of ICAMT will be to act as gatekeeper for developing countries in the field of advanced manufacturing technologies, by tracking the latest worldwide developments in leading-edge technologies and bridging the gap between the emerging market demands and the existing technology base. The stimulation and diffusion of new technologies into the relevant sectors will be centered on demand driven projects involving the private sector and key agencies from both developed and developing countries.

OBJECTIVES

The core objectives of ICAMT will be:

- To become a focal point of a global network of institutions and organizations concerned with advances in manufacturing.
- To enhance the manufacturing capability of industries in the developing world.
- To carry out training, studies and seminars on technology and management aspects of manufacturing, providing advisory services, back up support to industries and policy makers in developing countries.
- To mobilize financial resources.

PROGRAMME FOCUS

The extensive programme of global activity will be specifically focused on accelerating the development and application of manufacturing technologies. During the Pilot Activity Phase, ***the programme will focus*** on the following main areas of work:

- Establishment of a global network of affiliated centres of excellence.
- Development of a network of data bases with information on core capabilities, these being grouped as research based, private sector experts and company sector manufacturing capability, etc.
- Training projects to introduce key technologies and techniques.
- Promotion of joint industry visits to overseas facilities.
- Promotion of new manufacturing technologies and techniques, and management best practice on quality, maintenance, etc.
- Introduction of advances in manufacturing technology (AMT) in developing countries with specific focus on "*Green Manufacturing*".
- Transferring the technologies, know-how and knowledge on management of technological change practices and training.
- Building up/strengthening the institutional and technical capacity for technology promotion, transfer and absorption in the recipient countries.
- Linking the technology promotion and transfer mechanisms to investment opportunities ***through the UNIDO Industrial Partnership Promotion Network***.
- Bringing practical assistance in building up partnerships and in management of new partnership and innovative projects.
- Development of new initiatives and formulation of demand-pull and market-driven projects.
- Promotion of South-South and North-South cooperation.

Special efforts in the Work Programme of ICAMT will initially be put into strengthening the manufacturing sectors of less developed and developing countries in Africa and Asia. Strong consideration will be taken to the promotion of South/South cooperation between the Asian and African countries so that to easier absorb and adopt the new technologies in the developing economies.

At the initial stage of the Pilot Activity Phase, ICAMT will concentrate its activities on the following areas:

- World Class Manufacturing.
- Manufacturing in the Year 2000 and Beyond.
- Customer Responsive Enterprise.
- New Product Engineering.
- Lean Manufacturing.
- Green Manufacturing.
- Manufacturing and Total Quality Management.
- Enterprise Management Techniques for Competitiveness.

- Networked Supply Chain, etc.

The venue and other details of the planned meetings and training programme will be specified as soon as the Pilot Activity Phase starts.