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Technology Transfer: Assessing Needs Promoting Action

PROJECT
XP/INT/04/020

FINAL REPORT

Prepared by
United Nations Industrial Development Organization
and
African Regional Centre for Technology

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Abbreviations

ARCT	Africa Regional Centre of Technology
BPPT	Agency for the Assessment and Application of Environmental Technology
ERSI	Environment and Remote Sensing Institute
KNCPC	Kenya National Cleaner Production Centre
MCR	Micro-concrete Roofing
NEPAD	New Partnership for African Development
PGTF	Perez-Guerrero Trust Fund
SLATE	Scientific Laboratory and Teaching Equipment
SIRDC	Scientific and Industrial Research and Development Centre
TNA	Technology Needs Assessment
UNDP	United Nations Industrial Development Programme
UNIDO	United Nations Industrial Development Organisation
WSSD	World Summit on Sustainable Development

Acknowledgements

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We also acknowledge with thanks for the guidance and active participation of Dr. Ousmane Kane, Executive Director of ARCT during the project implementation.

Many thanks and acknowledgement goes to the delegates of the beneficiary countries for their active participation and enthusiasm throughout the implementation of the project.

Executive Summary

The initiative on Technology Transfer: Assessing Needs – Promoting Action was launched by the Director General of UNIDO on 2 September 2002 in Johannesburg during the World Summit on Sustainable Development (WSSD), and it is built on the realization that successful technology transfer depends crucially on the techno-managerial capabilities of developing countries to acquire the modern technologies appropriate for their needs and to stimulate innovation. Before technology transfer issues can be properly addressed, it is essential for a Developing Country to identify in advance its specific technological needs and capabilities. A national technology strategy in support to competitiveness, economic growth and environmentally sustainable development can be laid down in a coherent fashion only within a systematic framework, and possessing the proper methodologies and tools for the identification of technological capabilities both at national, sectoral and enterprise levels.

In order to assist Developing Countries in the technology needs assessment task, UNIDO has developed three levels of technology needs assessment (TNA) framework and tools to facilitate technology transfer:

- A national level TNA, focused on technology policy formulation and execution capabilities at the macro level, to verify the existence of a national technology strategy, a base of existing capable firms, appropriate research and technology organizations and effective policy making bodies.
- A sector level TNA, similar in approach to the national level TNA, but more “fine tuned” and centred on industrial sectors and cross-sector technologies, to assess the different capability levels on which different industrial sectors stand within the country, and how they compare when benchmarked against other countries.
- An enterprise level TNA, providing a detailed approach to auditing technological capabilities of business firms as the entities ultimately responsible for technology acquisition. The focus will be on specific technology strengths and weaknesses of companies and the identification of specific areas deemed to be strategic for technology absorption.

This project is a direct follow-up activity of such initiative, and it is placed within a cooperation framework between UNIDO and the Perez-Guerrero Trust Fund for Economic and Technical Cooperation among Developing Countries (PGTF).

The project objectives, intended outcomes and outcome indicators can be summarized as follows:
Project objectives:

- To strengthen institutional capacity in assessing technological capabilities and needs at national, sectoral and enterprise levels through UNIDO methods, tools and interactive processes; and
- To assist counterparts in developing capability-based technology upgrading programmes at national and sectoral levels and facilitate enterprise level technology needs matchmaking for techno-economic cooperation among participating developing countries.

Intended Outcome:

- Strengthened institutional capacity in assessing technological capabilities and needs at national, sectoral and enterprise levels
- Developing capability-based technology upgrading programmes to facilitate techno-economic cooperation among participating developing countries.

Outcome Indicator:

- Improve institutional capabilities in technology needs assessment and technology strategy development.
- Networking and cooperation in priority sectors among science and technology institutions, sustainable development councils, small and medium organizations, ministries of industry and planning from African, Arab, Asian regions

The target beneficiaries were science and technology institutions, sustainable development councils, small and medium industries organizations, ministries of industry and planning from African, Arab and Asian regions.

In general, the PGTF support was highly relevant and useful in achieving :

- Better understanding of the technology landscape in various countries in the South;
- Promotion of South-South technical cooperation, first among participants to the workshop and secondly among their respective institutions and countries;
- Development of a concrete and efficient TNA methodology which could be of great importance for any technology innovation or transfer strategy or process;
- Consolidation of ARCT-UNIDO technical cooperation to better address the critical issue of Africa’s Technological development as prime mover of the continent’s sustainable development.

1. Project results

The project has achieved its targeted outputs as can be seen from the table 1

Intended Outputs	Activities	Effected activities
1.1 Mastering UNIDO framework, methods and tools related to technology needs assessment at national, sectoral and enterprise level.	• To organize and conduct one Interregional group training workshop of 5 working days on technology needs assessment.	Group training workshop was held in Dakar, Senegal, 3-7 May 2007 and was attended by 23 participants from 13 developing countries (see item 4, page 10 for details)
1.2 To generate technological capability profiles at national and priority sectoral levels by applying learned techniques.	•To apply the technology needs assessment tools at national and sectoral levels through field-level operations in the home country.	The TNA framework was well conceived by the participants and enabled them to draw recommendations to make easy adaptation of TNA tool at, national, sectoral and firm levels (see pages 12-13 for the details of the recommendations).
2.1 Pathways to improve technology upgrading programmes at national and sectoral levels defined.	• To conduct selected national workshops with government officials, heads of sectoral institutions, academics, managers and practitioners to take forward the technology needs assessment results for national technology strategy development • To prepare preliminary national technology strategy based on needs assessment	Four national workshops on technology needs assessment were held and that enabled them to apply TNA tool at national, sectoral and firm levels (see annex I, II and III for the details of the national workshops). Moreover, each participating country was requested to prepare a national strategy based on the national workshop recommendations.
2.2 Creating a network of technology needs assessment among participating institutions to share and exchange experiences	• To promote technology needs proposals for ECDC/TCDC cooperation • To facilitate technology partnerships for business development.	Participating countries of the project were agreed to transfer technologies available from selected countries (see list of technologies proposed for transfer from Zimbabwe and Indonesia on pages 22-23). Moreover, the project was a good forum to exchange their country experiences among participating countries and enabled them to forge a network to work together in the future.

Table 1 list of effected activities

2. Project Approval Process

- *Technology Transfer: Assessing Needs – Promoting Action* initiative launched at the WSSD by UNIDO Director General on 2 September 2002.
- Project submitted for approval on 18 February 2003
- Consideration of the project proposal postponed by the Executive Board on 21 March 2003.
- Project proposal submitted to the Group of 77 for funding form the PGTF on 29 April 2003.
- Project proposal declared eligible for funding from PGTF, on 1 August 2003 (communication received on 10 November 2003). Disbursement of the approved funds to be made through UNDP after co-signature of a PGTF project document by a representative of UNIDO and UNDP's Director, Special Unit for TCDC.
- Project re-submitted for approval on 4 February 2004.
- Project approved on 14 May 2004: completion date set for September 2005.
- PGTF project document signed by UNDP representative on 10 February 2005 (received on 1 March 2005).

3. Project Implementation Process

Contacts were established at the beginning of February 2005 with the Director of the African Regional Centre of Technology (ARCT), Dr. Ousmane Kane, in order to plan the joint organization of the Interregional Group-Training Workshop on Technology Needs Assessment, to be held in Dakar as project activity.

On the 22 February 2005, a letter was sent by email to those country institutions having requested to take part in the project, as to inform them on the approval of the project and on its implementation. Project objectives and activities were listed and explained. Request was made to indicate a contact person within the organization, for subsequent communications. A tentative plan of action for the project activities was enclosed. The letter was copied to the UNIDO Field Offices for each country respectively.

Table 2 List of Institutions Contacted by Country

COUNTRY	INSTITUTION	CONTACT
Cote d'Ivoire	Bureau National d'Etudes Techniques et de Développement	Mr. Ahoua Don Mello, Director General
Indonesia	Center for Environmental Technology	Ms. Tusy Adibroto, Director

COUNTRY	INSTITUTION	CONTACT
Jordan	Ministry of Planning	Mr. Tayseer Al-Smadi, Director of Policies and Studies Department
Kenya	National Cleaner Production Centre	Mr. Kelvin Khisa, Deputy Director
Mongolia	Ministry of Industry and Trade	Mr. D. Surenkhor, State Secretary
Nigeria	UNIDO Field Office[1]	
Pacific Islands Group	Pacific Islands Forum Secretariat	Mr. Stan Vandersyp, Director Development and Economic Policy Division
Philippines	Department of Science and Technology	Mr. Florentino O. Tesoro, Undersecretary for Regional Operations
South Africa	Department of Science and Technology	Mr. Rob Adam, Director General
Tanzania	Small Industries Development Organization	Ms. Janet Minja, Director General
Thailand	Thailand Environment Institute	Mr. Patcharin Worathanakul
Vietnam	Vietnam Cleaner Production Centre	Mr. Tran Van Nhan, Director
Zimbabwe	Scientific and Industrial Research & Development Centre	Dr. Sharon Gomez, Director

The list of participants was being progressively updated as contact details of focal points in each organization were received and reminders were repetitively sent to those countries from which answer was delayed.

At the beginning of March 2005, the approved Project Document was distributed among counterparts and possible dates for the conduction of the interregional group-training workshop were discussed with ARCT; on this last issue, agreement was found on the first week of May 2005.

The search of possible international experts for the conduction of the training workshop was initiated immediately and the Job Descriptions were prepared. Contacts were established with international experts for the conduction of the group-training workshop. Information was provided to them regarding the overall project framework and workshop objectives. The formal recruitment procedure of Mr. J. de Caldas Lima and Mr. J. Butler as international consultants for the conduction of the training workshop was commenced at the beginning of April 2005.

[1] The UNIDO Field Office in Nigeria was requested to directly select and contact an appropriate Institution to be involved in the project.

Participating institutions were informed about the group-training workshop and they were requested to nominate a person as workshop participant, to be subsequently recruited as national consultant to carry forward the project activities at national level.

On 1 March 2005 the UNIDO Methodology on Technology Needs Assessment was disseminated among workshop participants and they were requested to study it for subsequent discussion.

The Aide-Memoire and the programme of the group-training workshop were drafted and submitted to ARCT and the two selected international experts for their comments and further contributions.

The mission of Mr. Padickakudi, project manager, to Dakar was organized. The mission took place between 29 March – 1 April 2005, with the aim of discussing the details of the implementation of the workshop with ARCT. The tentative programme of the workshop was refined and the decision to link workshop activities with the concomitant Ministerial Forum on “Technological Support and Capacity Building for Africa's Sustainable Development: Needs Assessment and Prospects for NEPAD and South-South Cooperation”, organized by ARCT, was officialised. Contacts with the UNIDO Representative were also taken.

After Mr. Padickakudi’s mission to Senegal, the list of workshop participants was updated. Reminders were sent to those organizations from which no communication was received, as for what concerned the selection of the workshop participant, namely Cote d’Ivoire, Jordan, Nigeria, Pacific Islands Group and Tanzania. UNIDO representatives were involved in the process of contacting the organizations in the respective countries.

The aide-memoire and the programme of the workshop were finalised and distributed to all workshop participants on 5 April 2005. Furthermore, participants were requested to prepare and submit a paper, to be presented during the workshop, on their respective countries’ national technology policies and strategies and they were provided with guidelines for the preparation of such presentations.

The list of workshop participants was finalised, and flight arrangements and hotel reservations were duly provided for each participant by ARCT, as agreed. Also, official invitation letters were provided by UNIDO to those participants necessitating entry visa to Senegal.

In parallel, the recruitment process of national consultants, with the task of taking forward the technology needs assessment in respective home-countries upon workshop completion, was commenced with the recruitment of Mr. Llanto and Mr. Yusman, from Philippines and Indonesia respectively.

4. Group-Training Workshop on Technology Needs Assessment for Developing Countries, Dakar, 3-7 May 2005

The Group-Training Program on Technology Needs Assessment for Developing Countries jointly organized by UNIDO and ARCT was attended by 23 participants from 13 developing countries from different regions of the world. In addition to the focus of the training program, workshop participants discussed a wide range of issues related to capacity building and shared technology policy and strategy experiences from their respective countries.

In the opening session of the workshop Dr. Ousmane Kane, Executive Director of ARCT, and Mr. Alain Nickels, UNIDO Representative, addressed and welcomed the participants and Mr. Padickakudi, Project Manager, introduced the objectives of the workshop and gave a presentation on the role of UNIDO in technology diffusion. The chairman and rapporteur for the workshop were also elected.

After the opening session, representatives from each of the 13 participating countries made presentations on the national technology policies and strategies for their respective countries to cover the role of technology support institutions and policy actions undertaken by their governments for promoting technology acquisition.

The national presentations revealed that efforts to adopt, transfer and disseminate technological products are going on in each of the participant countries, although the degree of commitment varies. The brief summary outlined hereafter compliments the above assertion.

Although, developments in science & technology in Cote D'Ivoire is still on its infant stage. Current strategies and efforts to support technological capacities of its enterprises are encouraging. Indonesia has a well-developed strategic policy of National Science and Technology Development administered by BPPT. The presentation proves efforts so far are satisfactory.

The Kenyan Institutional Machinery for the management of its science and technology policy, technology transfer, development, adaptation and utilization is largely in place and functional, but in dire need for serious coordination and regulation. While, the National Center for technology transfer of Mongolia is not in a position to satisfy the needs of national R&D and SMEs in sourcing and acquiring fresh technologies.

Nigeria's Technology Policy and Strategies have been in place for more than two decades albeit with many challenges and revisions. The new priority programme of the revised Science and Technology policy of the Government is gradually gaining popular and political support and is expected to act as a pull forward. Although, there are initiatives by the Philippine National Science and Technology to develop technological capabilities at the national, sectoral

and firm levels, there is still a need to orchestrate efforts so that meager resources can be effectively applied and more resources can be tapped.

Thailand's National Science and Technology Development Agency has a developed a plan to enhance the capability of responding to rapid changes in the age of globalization and to strengthen the country's long-term competitiveness. It is this plan, relevant agencies in the public and private sector use to promote the advancement of technology. What is more interesting is, the commission for science and technology in Tanzania is moving forward with clear strategic polices on capacity building, adoption, research and development of technology in the country.

Vietnam is embarking on the process of technology innovation to serve its national industrialization and modernization, but faced with lack of corporate managers determination on innovation and lack of technology information and Zimbabwe has noted that the presence of Science and Technology as well as Industrial Development policy is a corner stone towards the fulfilment of sustainable development initiatives. Thus, the government's efforts to promote Science and technology in the country by establishing a stand-alone Ministry of Science and Technology compliments the importance of such policies.

In the following sessions, technical presentations were given by UNIDO consultants J. Butler and J. de Caldas Lima. These were interactive in nature, and were followed by open discussions on issues of particular relevance for the workshop participants.

The first sessions were aimed at illustrating and explaining the Technology Needs Assessment framework: the tool was analysed and its purpose and applicability discussed. The UNIDO document on "Technology Needs Assessment for Developing Countries" was distributed to all participants, forming the base of the underlying methodology.

Subsequent presentations enriched the discussion by touching upon topics such as innovation management, technology management, capacity building and technology transfer. All the issues raised were analysed within the scope of the Technology Needs Assessment debate.

Workshop participants also attended the opening and closing sessions of the Ministerial Forum on "Technological Support and Capacity Building for Africa's Sustainable Development: Needs Assessment and Prospects for NEPAD and South-South Cooperation".
The concluding ceremony saw the workshop participants being awarded with a certificate handed by the different African Ministers chairing the Forum.

The final sessions of the workshop were characterised by group-works, held with the purpose of carrying a thorough analysis of the Technology Needs Assessment Tool at each level of application, namely national, Sectoral and Firm level. The structure of the tool was analyzed, and ways of adapting it as to make it applicable to country-specific conditions were discerned. The following recommendations were also made:

1. The TNA Framework has been developed to take into account the discussions and exchanges of all participants throughout the sessions, in order to address the different issues of specific countries, or sectors, or particular development related aspects. The framework therefore remains open to fine-tuning at each level in order to adapt it to particular prevailing circumstances and conditions.
2. In the process of implementation, the active commitment and participation of a wide range of stakeholders can be taken into consideration and the TNA methodology facilitates this consultation process.
3. Suggestions were offered by participants to introduce an international benchmarking scheme, which would provide additional incentives and benefits that would derive from the TNA exercise, and it was recommended that this aspect be given serious consideration.
4. The widespread diffusion of the TNA framework will require support mechanisms and translation of materials into various local languages so that the training of appropriate personnel is effectively facilitated.
5. The tool is an excellent platform for using and applying a range of UNIDO tools and techniques for guiding technology transfer, project management and other developmental approaches in a targeted fashion within the framework of sustainable development.
6. The recommendation to strengthen South-South Cooperation via the exchange of experiences and lessons derived from the application of the TNA framework emerged.
7. The respective country participants unanimously agreed to go ahead with the execution of the TNA framework at all the three levels (national, sectoral, and firm levels) in their respective countries and will therefore need technical support to do this.
8. The participants from the African Continent strongly urged for an implementation program in cooperation with the ARCT.
9. Participants also recommended that the ARCT be strengthened by UNIDO so as to enable it spearhead the much-needed South-South Cooperation within the TNA framework.
10. UNIDO was requested to set up a TNA monitoring and evaluation scheme among the participating countries for purposes of enhancing the sharing of lessons and experiences among participating countries.

Table 3 List of Country Participants

Country	Name and Contact Details
BENIN	**Mr. Bello GAFARI,** Directeur du Développement Industriel, Ministère de l'Industrie Commerce/Promotion Emploi MICPE/Route de l'Aéroport, BP : 363 Cotonou Tel : (229) 30 19 85 ; Fax : (229) 30 30 29 Email : bellogafari@yahoo.fr

Country	Name and Contact Details
CÔTE D'IVOIRE	**Mr. Raymond Laurent ASSOUA,** Ingénieur- Chef de Mission, Chargé de Mission auprès de la Direction Générale, Bureau National d'Etudes Techniques et de Développement 04 BP : 945 Abidjan 04 (Côte D'Ivoire) Tel : (225) 22 483420 ; Fax : (225) 2244 56 66 Email : lassoua@bnetd.ci ; rlassoua@yahoo.fr
INDONESIA	**Mr. Mohamad YUSMAN,** Research Scientist/Assistant Director, Agency for the Assessment and Application of Technology, BPPT Adresse : BPPT Building II, JL. MH. Thamrin N°8 2oth Floor JAKARTA 10340 INDONESIA Tel : 62 21 3169761 Fax : 62 21 3169760 Email : yusmanmsc@email.com myusman@plasa.com
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NIGERIA	**Mr. David Akosa OKONGWU,** Director General, National Office for Technology Aquisition and Promotion (NOTAP) Address : 1 Blantyre Street, Wuse II, PMB 5074 Abuja, Nigeria Tel : (+234) 9 5239823 ; Fax : (+234) 9 5239823 ; Email : dokongwu@yahoo.com
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	Ms. Ndeye T.T. DOUMOUYA née SEYE, Chef de Division Développement Technologie, ITA Adresse : Route des Pères Maristes Hann BP 2765 Tel (221) 859-07-07/85907-33 ; Fax : (221) 832-82-95 Email : ndoumouya@ita.sn ; nttseye@yahoo.fr
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	Mr. Didier DIOP, Directeur, Ministère de la Recherche Scientifique Dakar Building Administratif
	Mr. Moussa GNING, Secrétaire Générale de l'Association Sénégalaise pour la Promotion des Inventions et Innovations (ASPI) Adresse : Immeuble Fadh BP 23659 Dakar Fann, Tél : 659 85 98 Email : mgning@nomade.fr

Country	Name and Contact Details
	Mr. Ousmane SY, Expert Secteur Industriel, Bureau de Mise à Niveau des Entreprises Adresse : 9, Fenetre Mermoz S/C ADEPME, Dakar Tel : 869-70-85 Fax : 869-70-88 Email : ousmanesy@yahoo.com
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5. Follow up on Action Plan

As a follow up to the decisions made at the Group Training workshop in Dakar, on the 8th of August 2005, the following participants were asked to submit there action plan including specific financial assistance that they would need to implement the action plan:

Mr Assoua of Côte D'Ivoire
Mr Saiguran of Tanzania
Mr Khisa of Kenya
Mr Cheikh Oumar Anne of Senegal
Mr Yusman of Indonesia

Mr Llanto of the Philippines

6. Circulation of Draft Report

The draft report was circulated to all workshop participants on 9th August 2005.They were requested to provide information in the following areas:

- How far they had implemented the methodology/tools that were introduced at the workshop in Dakar.
- Their future plans for implementing the Technology Needs Assessment action plan on technology transfer.
- Areas of interest to exchange technologies available in their country amongst workshop participants.
- Their institutional needs for future technology transfer.

A further reminder on submission of the action plan was sent to all the members that had not responded as of 19th August 2005.

Most of the participants responded on the 24th and 26th of August 2005 with details of their action plans. However, there was no response on the action plan from Mongolia, South Africa, Nigeria and Vietnam. Another reminder was sent on the 29th of August 2005; even then, there was no immediate response.

7. Action Plans from Participating Countries

The following are the action plans prepared by each country after the workshop:

7.1. Benin

Benin having joined the workshop at a later stage did not prepare any action plan, as they still needed more guidance on the way forward. However, they have shown interest to participate fully in the second phase of the project. They also promised to send us their Institutional needs.

7.2. Cote d'Ivoire

Cote d'Ivoire prepared an action plan based on improving the production of its cashew nut industry. Being amongst the first ten world producers of cashew nuts with a production of approximately 90.000 tons per annum they would like to revamp this industry by improving technology used in the local industry of cashew nut transformation.

The cashew nut sector was chosen due to its potential but weak rate of industrialization. It is hoped that the conclusions and recommendations from

the workshop on technology transfer towards this sector will reinforce the capacities of the sector. Thereafter, the methodology can be extended to other agricultural sectors of the economy.

They plan to disseminate the information at all the three levels of the TNA starting with the sector level and then spread to the other two levels national and enterprise. In disseminating the information the following strategic steps will be carried out:

1. **To make TNA tool easily comprehensible by all key actors;**

- To create a TNA cell within the Department of Industry Energy and Mines of BNETD
- To translate the methodology tools into French so that it can be easily accessed by many
- To computerize part of the evaluation process
- To validate the process

2. **To diffuse the TNA methodology by;**

- Sensitising sectional actors
- To train sectional actors with TNA methodology
- To choose a pilot sector
- To organize a pilot sector workshop for the implementation of the TNA methodology and definition of the progress ways for the selected sector
- From the pilot sector workshop to extend the same methodology to the other industrial dies and key sectors of the economy like companies
- To gather sector formulations for the preparation of a national plan for reinforcement of technological capacities

3. **To build a plan of reinforcement of technological capacities starting from the TNA methodology;**

- To establish a strategy of establishment and technology transfer of strategic partnerships
- To formulate strategic plan of reinforcement of technological capacities

7.3. Indonesia

In Indonesia the following action plan was prepared:

- Translation and modification of the questionnaire

- Formation of a small core team consisting of six members from different departments. The team will be combined with representatives from the agencies/institutions/firms under the “working group”
- The combined team will implement the application of the TNA tools and assessment of technological capabilities at national, sectoral and enterprise levels through field level operations.
- Questionnaires will be distributed to all levels in some representative big cities of Indonesia.
- Data collected from direct and indirect interviews and observations based on the questionnaire given to them by UNIDO modified to suit the existing condition of the country will be analysed and formulated.
- Conduct national workshops with key stakeholders and decision makers to take forward the results of the technology needs assessment.
- Recommendation, planning and networking for further activities to be undertaken.

Indonesia has also been networking with Senegal on possible technology transfer in the solar energy sector.

7.4. Kenya

Kenya plans to hold two joint workshops for the TNA process for the dairy and coffee sectors. The Kenyan Dairy Sector was selected because of the numerous avenues for technology upgrading.

7.5. Philippines

The following activities were carried out in the Philippines:

In the second week of July 2005, which is, the Science and Technology week of the Philippines the following was done:

- Presentation of the UNIDO TNA methodology and tools before the top and middle management of the Science and Technology department and got approval for the formation of a Philippine TNA team. Three persons were identified to be members of the regional TNA team in each of the 15 regions of the country. This brings the total to 45 persons for the regional TNA teams and 8 for the National TNA Coordinating team. The national self-assessment audit tool was tested among the top management.
- Another presentation of the UNIDO TNA methodology and tools was made before all the provincial Directors of the department of Science and Technology representing 76 provinces of the country during the National Congress of the Provincial Science and Technology Officers

of the Philippines. The national self-assessment audit tool was also tested.

- Two orientation workshops on the UNIDO TNA methodology and tools were organised in August for all regional TNA teams of the country.

The Philippines further plans to hold a strategic workshop with UNIDO consultants in the months of October and November 2005.

7.6. Senegal

Senegal plans to set up a local committee for the implementation of the TNA methodology and have identified solar energy as their area of focus. Further, they have contacted Indonesia for possible technology transfer in the field of solar energy. Two companies with their contact persons have been recommended by Indonesia for further discussions with Senegal on solar energy technology.

7.7. Tanzania

Tanzania is closely working with the Commission for Science and Technology on the implementation of the TNA methodology and they are still working on their action plan.

7.8. Thailand

Thailand is still working out implementation procedures of the UNIDO TNA methodology. Meanwhile presentations were made to the following groups who have shown interest in the project:

- The secretariat of National Science and Technology policy committee
- The secretariat of National Biotechnology Policy committee
- The secretariat of National Nanotechnology policy committee

A recommendation was made to Thailand to contact other workshop participants on how to best implement the TNA methodology tool.

7.9. Zimbabwe

A presentation on the UNIDO TNA methodology was done to the research scientist in the Environment and Remote Sensing Institute (ERSI) of the Scientific and Industrial Research and Development Centre (SIRDC). It was then agreed that the TNA presentations be made at different seminars involving industry and Government and upon this agreement a presentation was made to an industrial cluster seminar on “Managing Industrial Waste”.

Additionally, they plan to hold a strategy workshop both at national and sector level to help in building capacities for policy implementation.

8. AVAILABLE TECHNOLOGIES

Below is a list of available technologies in Zimbabwe and Indonesia for future technology transfer amongst workshop participants:

8.1. Zimbabwe

- Technology in setting up calibration laboratories. (Recently, the National Metrology Institute was training people in Mozambique on how to set up a calibration laboratory).
- Design and product development technologies
- Design and development of original electronics and communication equipment for industrial instrumentation and control systems, process monitoring and automation. There is a product on the market known as a Science Laboratory And Teaching Equipment (SLATE), designed for teaching and student use during laboratory experiments.
- Technology transfer and training services in specialized areas of electronics and communications such as micro-controller technology, circuit design, electronic instrumentation and control.
- Consultancy and support services for industrial automation and control and communication.
- Foundry technology, extractive and physical metallurgy
- Sericulture and apiculture technology
- Plant and animal improvement production
- Enzyme process design and technology
- Fermentation process design and technology
- Biomedical technology
- Construction technologies and alternative building materials. There has been production of cost effective micro-concrete roofing (MCR) tiles and rammed earth houses for communities in Zimbabwe.
- Renewable energy systems (Biomass and solar energy).
- Remote sensing and Geographical information systems expertise
- Environmental monitoring and training (Environmental Impact Assessments, Environmental Management Systems, Water Quality Engineering).
- Technology transfer in software engineering, web design, computer literacy and ICDL

8.2. Indonesia

- Technology for natural resources development: natural resources inventory, energy resources, mineral resources, land and conserved area resources.
- Biotechnology and agro technology: agricultural cultivation, agro industry, bio-industry, pharmacy and medical.
- Technology of information and electronic, energy conservation and conversion, material, environment
- Technology of industrial processing, industrial of equipment and machinery, industrial of defence and security, industrial and system transportation.

Human Settlement Technology;

- Building Material Technology: R & D on Building Material such as for flooring, walling foundation of housing and building, etc.
- Typical Product Utilization of Fly Ash for improving concrete quality, oil palm waste brick, coconut wood as building material, pulp - cement board, black fiber concrete roof tile, etc.
- Building Structure and Construction Technology: R & D on building structure and construction such as earthquake resistance of building structure, building fire safety, housing for transmigration program, etc.
- Typical Product: Implementation of Modular coordination prototype house, Earthquake resistance house TG 26, RTG-45, perlite house, artificial lightweight aggregate, etc.
- Building and Spatial Technology: R & D on building and spatial planning such as for urban planning, city planning and architecture.
- Typical Product: Super blocks, transmigration, settlement, macrozonation map, plan and design information system.
- Housing Environment Technology: R & D on housing environment such as for flat, maisonettes, single or multi storey building including for public housing.
- Typical product: Incinerator with Fluidized Bed type, composted for domestic solid waste, mobile water purification unit, domestic waste water treatment using bio filter system, peat water treatment for tides area, etc.

Water Resources Technology;

- Hydrology Technology: R & D on hydrology such as monograph for designing artificial recharge structures, ground water supply using

shallow wells, combination scheme of an artificial aquifer and pond, etc.

- Hydraulic building and Geotechnical Technology: R & D on Hydraulic Building and Geotechnical such as Soil slope Reinforcement by using Steel Wire mesh, Light foundation of Hydraulic Structures on Soft soil.
- River and Sabo Technology: R & D on River and Sabo Technology such as Acid Deposition Controlling in River.
- Irrigation Technology: R & D on irrigation technology such as water wheels.
- Water environment technology: R & D on Water Environment Technology such as Groundwater Quality, river and industrial quality, autoimmunization of reads out unit of Dam Instrumentation, Integrated Hydrology Telemetry for Java.
- Lowland and River Technology: R & D on Lowland and River such as Beach Protection System, Deforestation Influence and so on.

Road Transportation Infrastructures Technology.

- Bridge and Road construction technology: bridge composites, reinforced concrete for bridges.
- Material and Road Pavement Technology: Geosynthetic, recycling procedure, Bituminous Mixture Deflect meter Measurement.
- Geotechnical Technology for Road: Remote Sensing and Geographical, Embankment, Land Slide Protection, Soft soil, etc.
- Traffic Engineering and Road environment: highway capacity study, road safety, noise & air pollution protection, etc.

9. Preparations for TNA National workshop

On 20th and 21st of September 2005 a request to set up tentative dates for the TNA national workshop was communicated to Kenya, The Philippines, Indonesia and Tanzania. After consultations were made with local stakeholders in all the above-mentioned countries the following tentative dates were set up:

The Philippines 23rd to 24th November 2005

Indonesia 29th to 30th November 2005

Kenya 5th and 6th December 2005

Due to the ongoing preparations for general elections in Tanzania the tentative dates were set for 16th to 17th January 2006.

On 29th September the tentative dates were communicated to the TNA UNIDO consultant Prof Jeff Butler. This was the followed by a telephone meeting between UNIDO Programme Manager and the consultant Prof Jeff Butler on 31st October at which all the tentative dates were confirmed with Prof Jeff Butler.

By 2nd November all the workshop dates in Indonesia, the Philippines and Kenya were confirmed .The venue of the workshop and accommodation for the consultant Prof Butler was also confirmed.

In the Philippines the Cebu city was selected as the venue of the workshop. The targeted participants are key members of the TNA teams and Regional Directors from the 16 administrative regions of the Philippines. Others are representatives from industry, Technology Transfer Application Research and Development sectors. The workshop would be interactive in nature with participants identifying national and sectoral challenges in technology transfer, innovation and sustainable economic development.

Jakarta was selected as the venue for the workshop in Indonesia. The participants evolve from industry, academia and research institutions that are actively involved in technology needs assessment. The workshop would be interactive in nature and conducted both in Indonesia and English. To stimulate discussions on appropriate technology needs participants would have to make contributions based on their experiences.

In Kenya, Nairobi was selected as the venue for the workshop. The workshop would focus on technology needs in the coffee and Dairy sectors. Presentations on these two sectors would be followed by group discussions for purposes of generating and absorbing additional ideas.

On the 15th of November 2005 the Aide Memoire and Agenda from the Philippines, Indonesia and Kenya were received. These were finalised by UNIDO Programme Manager Mr O. Padickakudi and distributed to all stakeholders including the following:

Ms Liang Dan Director Industrial Promotion and Technology Branch
Mr Jang-Won-Suh Director Asia and the pacific Bureau
Mr Chin-Pen Chua Field Operations Officer Asia and the Pacific Bureau
Mr M Matsushita UNIDO Representative in Indonesia
Ms Fatou Haidara Director Africa Bureau
Mr Imran Farooque Field Operations Officer Africa Bureau
Dr Kane Ousmane Director ARCT
Mr M Diop ARCT

10. National TNA Workshop in Thailand

In Thailand the UNIDO representative held a meeting with the focal point at the Thailand Royal Government Ministry of Industry. The meeting was organised to review amongst other issues the progress on “Technology

Needs Assessment ” Programme in the year 2005 and preparation of work Programme for 2006.

11. Feedback on National Workshops

On 1st and 7th December positive feedback was received on the workshops held in Kenya, Indonesia and the Philippines. Before the close of the year 2005 Kenya and Indonesia submitted their workshop reports. Moreover, Tanzania has submitted the report at later stage, whereas, the Philippines failed to submit the report.

11.1. National TNA Workshops

The National TNA workshops were held between November 2005 and January 2006 in Indonesia, Kenya, Tanzania and the Philippines. Each of the workshops had been held for a period of two days with an attendance of 25 to 60 participants. The workshop participants were from various sectors of the economy such as Research Institutions, Industries such as Agriculture (Dairy and Coffee sub-sector in Kenya) and government representatives.

An event was organised in all the four workshops, which usefully assembled a range of participants across the three levels-National, Sector and firm level. The majority of the participants were from government departments responsible for technology analysis and strategy except in Kenya where there was a stronger representation from the Coffee and Dairy sectors and where the agency promoting the application of TNA was a cleaner technology centre. All the workshops were conducted in the English language. In Indonesia at the request of the consultant the questionnaires were translated into the national language.

Each workshop begun with information sharing on the economy of the country and sectors by guest speakers.

The UNIDO TNA methodology was introduced by the UNDIO Consultant Prof Jeff Butler followed by group discussions. The group discussions would then be organised to discuss the methodology and how to plan for its application at national, sectoral and firm levels. The workshops served to discuss the merits of the UNIDO TNA methodology in particular and how other techniques might need to be used alongside.

The workshops ended with action points and recommendations for the TNA planning and implantation that were unique to each level and situation. For details on the action points and recommendations from the workshops refer to the Annex with individual national reports.

ANNEX I NATIONAL WORKSHOP REPORT
INDONESIA

REPORT

NATIONAL WORKSHOP ON TECHNOLOGY NEEDS ASSESSMENT FOR DEVELOPING COUNTRIES

Organized by
BPPT in cooperation with UNIDO

Jakarta, 29 – 30 November 2005

1. Background

Technology plays an important role in country's economic development. Many countries, such United States of America, Japan, South Korea, etc, rely on technology for their economic development. One of the reasons why the technology can boost their economic development is that because they can choose and develop the appropriate technologies that meet industrial needs. To choose the appropriate technology, technology needs assessment (TNA) is needed so that the technology chosen can meet industrial needs.

A national technology strategy in support to competitiveness, economic growth, and environmentally sustainable development can be laid down in a coherent fashion only within a systematic framework, and possessing the proper methodologies and tools for the identification of technology capabilities both at national, sectoral and enterprise level. UNIDO has developed the framework for TNA at three levels that are national, sectoral and enteprise level.

TNA is needed not only in developed countries, but also in developing countries such as Indonesia. Knowing the developed TNA is very important for Indonesia, because the methodology can be used by Indonesia to determine Indonesia's needs for technology. The dissemination of the TNA methodology can be carried by a national workshop which involves many participants who dealt with technology matters. Participants may interact each other in the workshop so that various perspectives can enrich the discussion to give more understanding about TNA methodology.

2. Objectives of the Workhsop

The workshop has two objectives that are :

a. to disseminate TNA methodology to the participants.
b. to find out focal point in each institution in Indonesia to disseminate TNA methodology

3. Workshop Activities

The workshop was carried out two days—29-30 November 2005—in the building II of Agency of the Assessment and Application of Technology, BPPT, Jakarta. The workshop organized by BPPT in cooperation with UNIDO was attended by 30 participants. The participants came from 3 institutions that are government institutions, research and education institutions and private company.

First day of the workshop began with the opening session of the workshop. Mohamad Yusman—workshop chair—reported the attended participants and organization of the workshop. Nahrudin Alie—program officer of UNIDO—welcomed the participants and explained some cooperation that have done with BPPT. And, Tusy A. Adibroto—Director of Environmental Technology, BPPT—explained the objectives and importance of the workshop. Moreover, she hoped that the cooperation between BPPT and UNIDO can be enhanced in the future.

After the opening session, Erry Ricardo Nurzal—local expert—made a presentation about economic, social, environmental and technological conditions and priorities of Indonesian sustainable economic development. This presentation was aimed at giving some background information which are needed for the group discussion about applying TNA methodology.

In the following sessions, technical presentations were given by Jeff Butler—UNIDO consultant. He introduced what UNIDO TNA methodology is. He also explained three level that can be used to apply the methodology. At the national level, TNA focuses on technology formulation and execution capabilities and to verify the existence of a national technology strategy, a base of existing capable firms, appropriate research and technology organization and effective policy maing bodies. At sector level, TNA can assess the different capability levels on which different industrial sectors stand within the country, and how they compare when benchmarked against other countries. At enterprise level, TNA can provide a detailed approach to auditing technological capabilities of business firms as the entities ultimately responsible for technology acquisition. The focus is on specific technology strengths and weaknesses of companies and the identification of specific areas deemed to be strategic for technology absorption. Moreover, he explained where, when, and how to apply the TNA methodology.

At the second day of the, Jeff Butler began with the explanations of some tools that can be used to apply TNA methodology. The tools explained are IDEF, technology roadmapping, and innovation uncertainty map. Jeff Butler explained that IDEF is a method designed to model the decisions, actions, and activities of system. Effective IDEF models help to organize the analysis of a system and to promote good communication between the analyst and the customer. IDEF is useful in establishing the scope of an analysis, especially for a functional analysis. As a communication tool, IDEF enhances domain expert involvement and consensus decision-making through simplified graphical devices. As an analysis tool, IDEF assists the modeler in identifying what functions are performed, what is needed to perform those functions, what the current system does right, and what the current system does wrong. Thus, IDEF models are often created as one of the first tasks of a system development effort.

Besides IDEF, he explained about technology roadmapping and innovation uncertainty map. He said that technology roadmapping can be used to determine strategic technology management and planning. Roadmapping provides a framework for supporting integrated and aligned multifunctional

strategic planning in terms of both market pull and technology push, achieving a balance between market requirements and technological capability, with a key benefit being the communication associated with both th roadmap and roadmapping process. Moreover, he explained innovation uncertainty map. This tool can be used to determine which problems having high/low uncertainty market and high/low uncertainty technology.

By using innovation uncertainty map, Jeff Butler and participants discussed and determined some topics which can be used for group discussions. Some topics chosen are the improvement of technology capability, automotive component sector, nuclear energy, energy for Aceh, and transportation in the regions.

Based on the topics, participants were divided into 5 groups. Each groups consisted of leader of the groups, reporter, network manager, and members of the groups. Then, each group discussed the assigned topic. After discussing the topic, each reporter of the five groups presented the results of the discussions. With questions and answers model, each participant can learn from each other.

Then, Jeff Butler gave some comments to each group. This situation enriched the understanding of the application of UNIDO TNA methodology. Finally, the closing remarks of the workshop were given by Habsari Kuspurwahati—representative of Center for Innovation Policy, BPPT.

4. Conclusions and Recommendations

4.1 Conclusions

(1) Technology needs assessment involves an analytical process which is necessary for countries and institutions to go through in terms of establishing national priorities for technological development. Technology needs assessment should be a prerequisite for the formulation of strategies for technological development.
(2) It is essential to involve all national key constituencies in the TNA exercise in order to better ensure their commitment in the implementation of identified technological capacity-building needs.
(3) Participants recognized the need to integrate environmental concerns in the establishment of methodologies for TNA.

4.2 Recommendations

(1) In the future, UNIDO can make a concrete project on applying TNA methodology. This project can be useful for UNIDO to know what kind of technology needed for Indonesia. The results

of the project can be useful for donor countries/organization to know actual needs of Indonesia in the development of technological capacities and help donors in determining their aid priorities through their involvement in technology needs assessment at the national level.

(2) UNIDO can make some workshops on TNA in some provinces in Indonesia. This workshop can useful to disseminate the application of UNIDO TNA methodology.

(3) International workshop of the TNA in Indonesia, if possible to be funded by UNIDO, might foster the realization of South-South cooperation in the future.

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ANNEX II NATIONAL WORKSHOP REPORT KENYA

Proceedings of the

National Workshop
on
Technology Needs Assessment at the College of Insurance, Nairobi - Kenya

PROJECT
XP/INT/04/020

KNCPC
Nairobi, Kenya
December 5-6 2005

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
In cooperation with
KENYA NATIONAL CLEANER PRODUCTION CENTER

STAKEHOLDER CONSULTATION AND REVIEW WORKSHOP ON THE RESULTS OF A TECHNOLOGY NEEDS ASSESSMENT EXERCISE FOR THE KENYAN DAIRY AND COFFEE SUB-SECTORS.

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1. Introduction

The transfer of technology is central to sustainable development and poverty reduction. But before technology transfer issues can be addressed, it is essential to identify in advance the specific technological needs and capabilities of a country. This will form the basis of a national technology transfer strategy that will support competitiveness, faster economic growth and sustainable development. It is in view of this that the Kenya National Cleaner Production Center (KNCPC) undertook a Technology Needs Assessment (TNA) exercise for two key sub-sectors of the Kenyan economy namely the Dairy and Coffee. This exercise targeted three levels of TNA framework for purposes of facilitating effective technology transfer.

- At national level TNA, focused on technology policy formulation and execution capabilities at the macro level, to verify the existence of a national technology strategy, a base of existing capable firms, appropriate research and technology organizations and effective policy making bodies for the dairy and coffee sub-sectors.
- At sectoral level, the focus was on assessing the performance of the sectors in relation to what was happening in other parts of the world.
- At enterprise level, the aim was to provide a detailed approach to auditing technological capabilities of the two sub-sectors, as individual enterprises are responsible for technological acquisition in Kenya. Emphasis was put on specific technology strengths and weaknesses of companies and an identification of specific areas deemed to be strategic for technology absorption.

The "Technology Transfer: Assessing Needs – Promoting Action" project aims to strengthen the institutional capacity of countries in assessing technological capabilities and needs, and help them to develop capability based technology upgrading programs at national, sectoral and enterprise levels. At the same time it aims to foster technology cooperation, especially South-South, among participating countries.

UNIDO has been implementing TNA framework with the Kenya Cleaner Production Center and the African Regional Centre for Technology (ARCT) as strategic cooperating partners at national and interregional level. The Project is jointly funded by UNIDO and Perez-Guerro Trust Fund.

2. Background

Kenya is basically an agricultural economy. Agriculture contributes approximately 25% to the overall Gross Domestic Product (GDP). The livestock industry offers vast opportunities for economic growth especially in the Arid and Semi Arid Lands (ASAL) areas, which has over 50% of the Kenyan livestock. Major challenges in the sub-sector include low farm productivity, over reliance on obsolete technologies, poor marketing infrastructure, limited access to credit, and high costs of farm inputs among others. The sub-sector is also subject to lags in policy and legal frameworks that are currently not in line with the requirements of a liberalized economy. Dairy production is a major activity in the livestock sector and an important source of livelihood for about 600,000 small-scale farmers. Milk production nearly doubled from about 1.3 billion litres in 1981 to about 2.5 billion litres in 1990. Since then, output levels have fluctuated between 2.1 and 2.4 billion litres depending on weather. About 63% of milk produced in Kenya is marketed, 30% is consumed at home, and 7% is fed to calves.

Since the liberalization of milk marketing in 1992, there has been a proliferation of new processors and 45 have been licensed. These new processors handle about 600,000 litres per day, which contrasts with the Kenya Cooperative Creameries (KCC) capacity of about one million litres a day at its peak. The informal marketing system previously confined to rural areas has now become more pronounced in urban areas in spite of the attendant health and hygiene risks, informal milk marketing now accounts for more than 60% of the total marketed volumes due to lower prices relative to the packaged substitutes. There are plans to restructure the Dairy Industry Act, Cap 336 so that it is in line with the liberalized market. The dairy policy will also be revised so that it focuses on critical issues that influence the sub-sector such as marketing arrangements to enhance competition, products quality control and assurance and the management of strategic dairy reserves. To realize the goal of the policy, the Government will establish programs to enhance access to appropriate production technologies and inputs and increase efficiency and overall productivity.

The technologies required to address and reduce post harvest milk loses should be applied throughout the entire supply chain. Technology transfer should therefore include:

- On-farm feeding strategies aimed at reducing supply fluctuations
- Milk preservation and cooling methods, which should be simple and economical
- Milk collection systems that are efficient. A combination of technologies should be tested to shorten distance and time between collection and delivery to plant or consumption point; and
- On-farm processing, cottage industries and/or micro-enterprises to deal with seasonal supply surges through processing of long life dairy products at the village level.

Coffee production has declined significantly from a peak of 129,000 tones in 1987 to 95,000 tones in 2000. The decline is attributed to declining world coffee prices, high input costs, erratic weather, disease and pest upsurge, limited credit to small holders, inefficient management of coffee co-operative societies, use of non-efficient processing technologies, limited value addition, poor marketing and disharmony between current policy and its legal framework.

3. Objectives of the Workshop

- To develop a strategic approach to innovation and technology transfer for sustainable economic development (in line with the Millennium Development Goals)
- To help participants and colleagues to examine how well different institutions, agencies, or teams interact with each other in economic and innovation systems (at an international, national, regional, or sectoral level)
- To understand more clearly how technology transfer and innovation processes can be managed and how relevant systems and networks operate
- To help improve the performance and sustainability of developing economies, in particular through the better acquisition, use, development and exploitation of technology.
- To recognize the different factors and perspectives that might constrain innovation and sustainable development, and the strategic challenges and opportunities which might stimulate it, and which need to be addressed.
- To understand the characteristics of different types of innovation project and innovation strategies and how the situations need to be managed accordingly.
- To learn how TNA can help to identify needs and opportunities for technology transfer and how to deal with opportunities within complex or large scale projects.
- Developing collective or networked capabilities for TNA so that all sectors and levels can benefit.

LIST OF SUITABLE GROUP DISCUSSION TOPICS

Group 1: Technological Needs of the Kenyan Dairy Industry

Group 2: Technological Needs of the Kenyan Coffee Industry

4. Workshop Structure

This stakeholder consultation and review workshop will last for two days. The first day will be dedicated to the presentation of background papers on Technology Needs Assessments (TNAs) while the second day will be dedicated to the presentation and validation of the TNA results from the two sub-sectors.

5. Target Participants

The workshop is targeting all key stakeholders from the dairy and coffee sub-sectors. An approximate number 25-30 participants are expected to attend this two-day workshop.

6. Workshop Proceedings

SESSION I: CHAIRMAN DR. CHARLES MOTURI

6.1. Welcome Address by KNCPC Director (Ms. Jane Nyakang'O)

The KNCPC Director welcomed participants to the stakeholder's consultation and review workshop in connection with the Technology Needs Assessment (TNA) exercise for the Dairy and Coffee sub-sectors of the Kenyan economy. She informed the participants that the workshop was organized as a follow up to the successful TNA survey that was carried out jointly by KNCPC and KIRDI in which most of the invited participants were actively involved. She appealed to the participants to critically evaluate and authenticate the survey results with a view to helping improve the performance of the sub-sectors in question. She urged the participants to look at areas that will require improvements and develop strategies that focus on the much needed innovation and technology transfer for purposes of promoting sustainable development. The KNCPC Director introduced Prof. Jeff Butler, a UNIDO consultant and a research fellow from the University of Manchester Business School. She thanked him for finding time to come to the workshop. She observed that his contribution and experience in TNA will go along way in enriching the Kenyan outcome.

6.2. Introductory Remarks and Technology Challenges of the Kenyan Dairy Industry by Mr. Kelvin Khisa (Deputy Director KNCPC)

The Deputy Director informed the workshop that the Project "Technology Transfer: Assessing Needs – Promoting Action" was developed by UNIDO and agreed upon at the World Summit on Sustainable Development (WSSD) in 2002. Its main objective is to enable developing countries to Audit their current technological capabilities and identify their strengths and weaknesses at national, sectoral and enterprise levels. In other words, it is designed to assist developing countries in strengthening their capabilities in managing, absorbing and mastering technology. At policy level, technology foresight permits to define strategic development directions, guide innovation policy and set up supporting infrastructure. At institutional level, strengthening national innovation systems, technology and innovation centers, technology parks, etc and networking them with UNIDO International Technology Centers, bringing a culture of innovation to business, strengthening R&D institutions to become "demand driven" and respond effectively to industry needs. So far UNIDO has set up over 17 International Technology Centers in Italy, India, China, Australia, Brazil, Russia, South Korea, Vienna, Belarus, Ukraine, Venezuela, and Senegal (Francophone).

Mr. Khisa informed the meeting that Technology Centers are normally entrusted with the following tasks:

- Monitor technological trends
- Bring the innovation results and innovation culture to the business environment through linking technology with capital, industry and market place
- Facilitate transfer and absorption of technology to developing countries (North-South and South – South). Identification of needs, sourcing and acquisition of technology
- Providing training and support to SMEs in technology transfer, commercialization, absorption and diffusion, as well as in managing technological change on a sustainable basis.
- Network with R&D institutes, universities, professional and industrial associations, government institutions, etc
- Linking demand driven projects to industrial investments
- Act as a one-stop shop for technology sourcing.

At enterprise level, efforts are focused on building capacities in the transfer and commercialization of technology and sustainable mechanisms of managing technology change.

He observed that the TNA tool is designed to:

- Map out the overall capability level
- Profile the capabilities of a country showing strengths and weaknesses
- Assess the effectiveness of current mechanisms for technology acquisition

- Provide valuable information to help select technological priorities within a coherent strategy for technology upgrading and acquisition.

At the same time, it aims to foster technology cooperation, especially South-South, among participating countries.

He informed the meeting that on 3 – 7 May 2005, he attended an Interregional Group Training Workshop on Technology Needs Assessment for Developing Countries in Dakar Senegal. Participants to this training workshop were drawn from 14 different countries that were spread over 4 continents. He noted that this workshop was a follow up of one of the resolutions made at the training workshop. He noted that as much as possible the participants should attempt to underscore the importance of technology in enabling Kenya as a country to realize its Millennium Development Goals (MDGs). He observed that all the three revolutions that mankind has witnessed (Agricultural, Industrial and Digital) have all been driven by science and technology.

6.3. Brief Remarks by Prof. Jeff Butler

In his brief remarks Prof. Butler thanked the KNCPC for inviting him to this very important workshop. He informed the participants that there is need to develop Technology management capabilities at all levels of the economy. He stressed the need for a through understanding of the UNIDO TNA methodology before its application. Prof. Butler informed the meeting that the workshop was meant to be as interactive as possible so as to be able to have a practical feel of how the tool works.

6.4. Brief Remarks by the Director of Kenya Industrial Research and Development Institute (KIRDI)

In his brief remarks DR. Charles Z. Moturi, the Deputy Director of KIRDI, expressed apologies from the Director - KIRDI Dr. Patrick. M. Muturi whom he said would have wished to be with us but due to other pressing assignments, was not able to join us. The Deputy Director, on behalf of the Director - KIRDI, took the opportunity to welcome all the participants to the workshop, which he stated was very important and timely for the two sub-sectors in the Kenyan economy. He observed that technology transfer was of great concern to KIRDI since it is one of the instruments of industrial development and a vehicle of improving living standards of the people. Dr. Moturi alluded to the Science and Technology Act and indicated that it has provision for Technology Needs Assessment (TNA) and Technology Transfer as a way of striving to achieve the three pillars of sustainable development.

He noted that KIRDI's mandate is to carry out research and development in industry and other allied technology together with its commercialization. The Country's Kenya Bureau of Standards (KEBS), takes care of the policy that relates to technology in terms of standards development and regulation. He underscored the importance of the workshop by stating that KIRDI welcomes

the active participation of all participants in terms of identifying technological gaps that exists at both enterprise and sectoral levels of the two sub-sectors.

He further observed that there is need to source, procure and manage technologies competitively if the country has to make progress towards achieving sustainable development. He pointed out that the establishment of a technology research and development centre in Kenya will assist in facilitating the complex technology transfer process that involves, technology sourcing, negotiation, licensing, and procurement. Dr. Moturi emphasized the need for the workshop to critically look at the study findings and recommendations of the two sub-sectors and come up with the realistic way forward. He expressed hope that more such studies should be undertaken for other sub-sectors of the Kenyan economy.

6.5. Brief Remarks by the Director of Industry

In his brief remarks on behalf of the Director of Industry, Mr. Silas Kiragu, a senior Deputy Director of Industry thanked all the participants for finding time to attend the workshop. He thanked KNCPC for organising the workshop and UNIDO and KNSCT for their financial and technical support. He expressed apologies from the director of industry whom he said would have wanted to grace the occasion but was officially out of the country. He informed the participants that the dairy and coffee are important sub-sectors of the Kenyan economy. He explained that the dairy industry plays an important role in improving the livelihoods of Kenyans who live in arid and semi arid parts of the country. He informed the participants that the coffee industry has been having problems due to poor technology and under exploitation of the entire range of its products. He observed that new products such as coffee briquettes have been made from coffee waste but the commercialisation of this technology has not been successful. He wondered why the composting of coffee berry waste has not been embraced widely. On behalf of the Ministry of Trade and Industry, Mr. Kiragu thanked Prof. Butler for finding time to come to Kenya and share his wide experience on TNAs and also KNCPC for the good work they are doing in relation to the undertaking of technology needs assessments. He expressed hope that the results of the workshop, in conjunction with other works already undertaken in the two sub-sectors shall assist the Government in meeting its set obligations in the Economic Strategy Paper for Wealth and Employment Creation.

SESSION II CHAIRMAN: MR. KIRAGU

7. The Technological Challenges of the Kenyan Coffee Industry (Mr. Kenneth Aduda)

Mr Aduda described the coffee plant as a woody perennial evergreen dicotyledon that belongs to the gender Coffea. He observed that there are many varieties of coffee, but for trade purposes, the Coffea Arabica and Coffea Robusta are the most important. Coffea Arabica is the main plant grown in Kenya with few patches of Coffea Robusta.

7.1. Appearance

The coffee plant can grow to heights of 10 meters if not pruned, but producing countries will maintain the coffee at a height of 1.5 to 3m, which ensures high yields and makes harvesting easy.

7.2. Harvest

He reported that Coffee trees take approximately five years to mature. The tree leaves are broad, dark green and shiny. Blossoms are white and star-shaped fragrant flowers. Trees blossom over a 6 to 8 week period in countries such as Brazil and many countries located in the equator such as Kenya During the harvest only red ripe cherries are picked, and always by hand. This entails frequent picking rounds, with each tree picked every ten days or so. Because harvesting is so labour intensive, it is one of the most expensive steps in processing. The time span between blossom and harvest generally covers 6 to 9 months depending on the altitude and prevailing weather conditions.

Table: Production, area and Average yield of Coffee by type of grower, 1998/9 – 2002/3

	1998/99	1999/00	2000/01	2001/02	2002/03	Average
Area (Ha) '000						
Co-ops	128.0	128.0	128.0	128.0	128.0	128
Estates	42.0	42.0	42.0	42.0	42.0	42
Production (tones) '000						
Co-ops	39.4	62.2	25.0	28.8	34.0	37.9
Estates	28.7	38.5	26.9	23.1	21.4	27.7
Yearly Total	68.1	100.7	51.9	51.9	55.4	
Average yield (kg/Ha).						
Co-ops	308.0	485.9	*193.8*	*198.8*	265.8	290.46
Estates	683.0	916.7	*640.5*	*537.0*	509.9	657.42

(Source: Economic Survey 2004)

With modern cultivation methods, the harvest in a good year can reach 4000kg per hectare. The table above shows average yields achieved between 1998 and 2003 in Kenya.

7.3. Green Coffee

The unprocessed coffee is called green coffee. The coffee bean is the seed inside the berry.

7.4. Coffee Growing Areas

He informed the workshop that Coffee is grown in some 70 countries around the world. Brazil ranks first and produces nearly 30 percent of the coffee followed by Colombia (16%), and Mexico (4%). In 1999, Kenya ranked 11th amongst the producers and exporters of coffee worldwide.

7.5. Altitudes

He noted that the altitude at which coffee is grown plays a major role in determining the quality of the bean. Because there is less oxygen at higher altitudes, coffee grown at higher altitudes take longer than plants grown at lower altitudes. This allows the flavours to develop more fully and produces beans that are delicate and flavourful. Ideally, 1500-2500 mm of rain will fall over a nine month period with a three month dry season coinciding with the harvest (Mitchell, 44)

7.6. Growing Conditions

He informed the meeting that Coffee trees produce their best beans when grown at high altitudes in a tropical climate where there is rich soil. Such conditions are found around the world in locations along the Equatorial zone, between latitudes 25 degrees North and 30 degrees South

7.6.1. Climate

He observed that Arabica Coffee is grown in relatively cool climates in the region between the Tropic of Cancer and Capricorn. *The optimum temperature is between 15-24ºC (59-75ºF) year round*. Photosynthesis is slowed above these temperatures and frost damage can occur when temperatures hover around 0ºC.

7.6.2. Soils

He noted that Coffee is highly sensitive to the type, moisture and nutrients contents of the soil. A strict crop management scheme is therefore mandatory to ensure high yields. Presence of an adequate supply of essential mineral elements, temperature, moisture, friability, ph, drainage, degree and orientation of slope are important. The soil must be porous to allow for easy drainage after heavy rains, organic enough to hold moisture between rains, wet and soft so that the feeder roots and deeper water tapping roots growth is possible. He noted further that most of the world's coffee is grown on volcanic soils in areas near extinct and live volcanoes, where soils

are rich in minerals and slightly acidic (PH 4.5-5.0) Potassium and iron are some of the minerals that are important in healthy coffee shrubs

7.7. Enemies

He singled out the most feared enemy of coffee plant as leaf rust; a mould that infects the leaf and makes it turn brown and black eventually fall off. Other enemies are insects and caterpillars. Another constant threat comes from the weather conditions; hail, storms, rainfall, drought and frost can be fatal.

7.8. Arabica

He described Arabica as a glossy leafed shrub or small tree. Its leaves are relatively small and the flowers fragrant and white. Arabica coffee usually receives a premium for its superior flavour and aroma. Arabica is more suited to higher cooler climates e.g. 600-2000m above sea level and 15-20°C.

7.9. Robusta

He noted that there are many different types of Robusta varieties. In general, they can thrive in hotter lowland areas e.g. below 900m above sea level and over 20°C. Robusta coffee is preferred for instant coffee production due to its higher soluble solid extraction.

7.10. Cultivation

He noted that Coffee is highly sensitive to the type, moisture and nutrient content of the soil. Cultivation, care and harvesting of coffee is extremely labour intensive. Coffee is highly sensitive to management in the whole spectrum.

7.11. HARVESTING PERIODS

He informed the workshop that at around 9 months after the flowers appear; the berries are ripe and can be harvested. Harvesting is mainly carried out by hand. The main harvesting period lasts for 4 months for Arabica coffee, and for a little longer in some countries depending on the climatic and geographic differences.

7.12. Picking

He listed the three main methods of picking coffee as:

- Hand-Picking
- Strip Picking
- Mechanical Harvesting

7.13. Hand - Picking

Though most labour-intensive, it ensures that only the ripe, high quality berries are picked. High quality Arabica beans are almost always hand-picked. It is also referred to as selective picking.

7.14. Strip Picking

In this method, the berries are not picked individually, but rather by stripping the branch of all berries, the unripe, ripe, overripe and the leaves with one sweep of the hand by the pickers. This method is common in Brazil and Indonesia, and especially for the cheaper commercial Robusta coffee.

7.15. Mechanical Harvesting

On large plantations in Brazil, harvesting by machines is sometimes used.

7.16. PROCESSING

The two coffee beans make up only one-third of the coffee berry, the rest consists of flesh (pulp), skin and husk, all of which must be removed so that the beans remain. Two different methods of processing the coffee beans have been adopted namely wet processing and dry processing.

7.17. Wet Processing

In this method, he noted that the berries are first fed though a water bath to soak them and remove impurities. This method is mainly employed in Central America and Kenya.

The process involves:

- Washing
- Fermentation
- Pulping
- Drying
- Hulling
- Sorting and Grading

Though relatively expensive, it is beneficial to the quality of the coffee. It is water intensive and has been a major source of water pollution.

7.18. Dry Processing

It is a simpler technique, which is less labour intensive, however, the cheaper production costs are off-set against length of time and loss of quality. This method mainly employed in Brazil and some parts of Africa is used for lower quality Arabica and Robusta berries. Once all the twigs, leaves, stones and other foreign objects have been sieved, the drying process which takes two to three weeks begins.

The process involves:

- Drying
- Hulling
- Cleaning and Selection
- Cleaning and Sorting / Grading

7.19. Inspection and storage

The sorted coffee is packed in sisal bags, each holding 50kg (Kenya), 70kg (Colombia) or 60kg (rest) for inspection the next stage in the process. A sample is taken from a large number of bags for examination, roasting, grinding, brewing and tasting by experts. The bags are given a quality seal and can be sent to the market.

7.20. GRADING STANDARDS

He stated the Kenyan coffee grading as:

PB: Round beans, which usually grow as one bean in a single cherry bean. About 10% of coffee falls in this grade.

AA: This grade has a good size formation of large beans (7.20 mm screen). This grade usually fetches a higher price than any other grade.

AB: This grade is a combination of two grades, A and B:
A – 6.80 mm screen and
B – 6.2 mm screen.

AB is regarded as a representative of the other grades in a consignment and usually there is more coffee of this grade than o any other grades in a consignment. It is also a popular grade that fetches good prices.

E: This is the largest of all the grades in size and has been named Elephant grade. Usually, there are two beans joined together to form the seed in a single cherry. It is the source of ears when the beans separate during handling. This grade also includes the very large PB beans. Like PB, this grade is normally in small quantities in a consignment.

TT: This grade is composed of light beans, which are ragged and are usually separated from all other grades.

T: The smallest and thinnest beans, most of which are in the form of chips. Most of the beans in this grade are broken and flawed. In classification, his grade is always below the other grades.

C: Smaller beans than B and most of the thin beans fall in this grade.

BUNI: This is coffee that has not gone through wet processing either by because it was not picked or because it fell from the trees after ripening. About 7% of the total crop falls into this grade, which generally fetches lower prices and has a sour tasting liquor.

The above grades are then subjected to a rigorous classification by the liquoring Department of the Board to assign classification standards for the quality of the raw and roasted beans and the cup taste. The cup quality is usually described as fine, fair to good, fair average quality down to common plain liquor. Coffee of good raw quality has a good roast quality and appearance and also has a pleasant flavour.

7.21. Bulk Transport

He informed the workshop that majority of the coffee is shipped directly from the country of origin to the country of consumption. Kenya's coffee market exports to its traditional markets and other markets has been as follows in the recent past:

2001/02	Destination	No. of bags (60 kgs)	% Market share
	Germany	248,868	29.90
	Sweden	96,402	11.60
	U.S.A	86,757	10.40
	Belgium	75,617	9.10
	Finland	39,110	4.70
	U.K	35,290	7.20
	Others	249,793	30.10
	TOTAL	831,837	100.00

7.22. Storage Periods

Once dried, the green coffee can be stored for about a year without appreciable loss of in quality. Green crop of up to a year is designated current crop. Older than one year is marketed as old crop.

7.23. Technological Challenges

- Poor crop husbandry is responsible for the relatively low yields at both small holder and estate level farmers

- Limited product range as regards the level of coffee processing
- Over reliance on wasteful and inefficient coffee processing technologies (water, energy)
- Limited technological innovation
- Limited use of coffee processing by-products
- Limited organic farming and other good agricultural practices in the sector
- Inferior quality control practices
- Limited information on existing markets and technologies
- Predominantly rain-fed farming
- Lack of a technological strategy for the sector

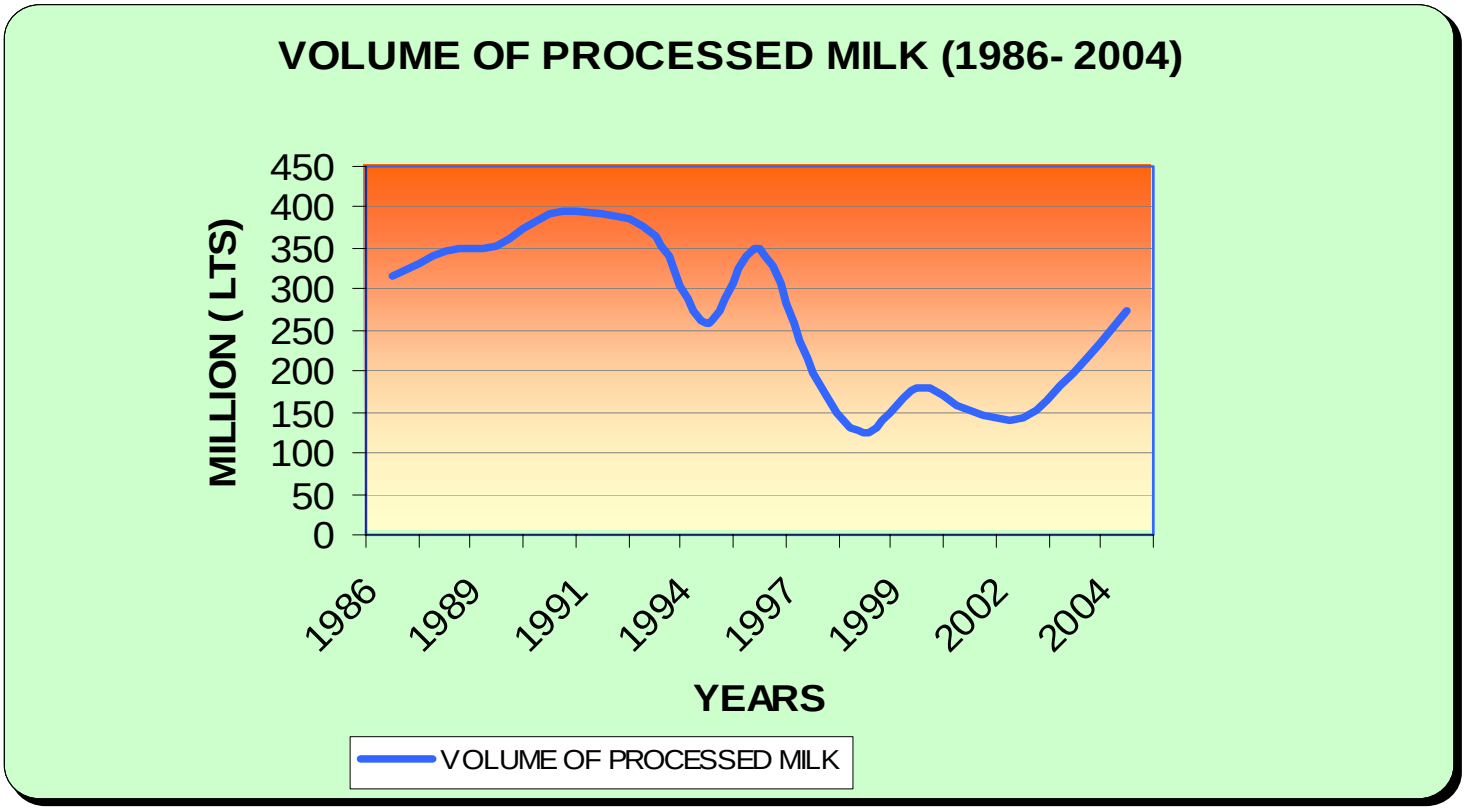
7.24. Market

Kenya's crop is not a factor in determining the world coffee prices. There is need for the branding of the Kenyan coffee.

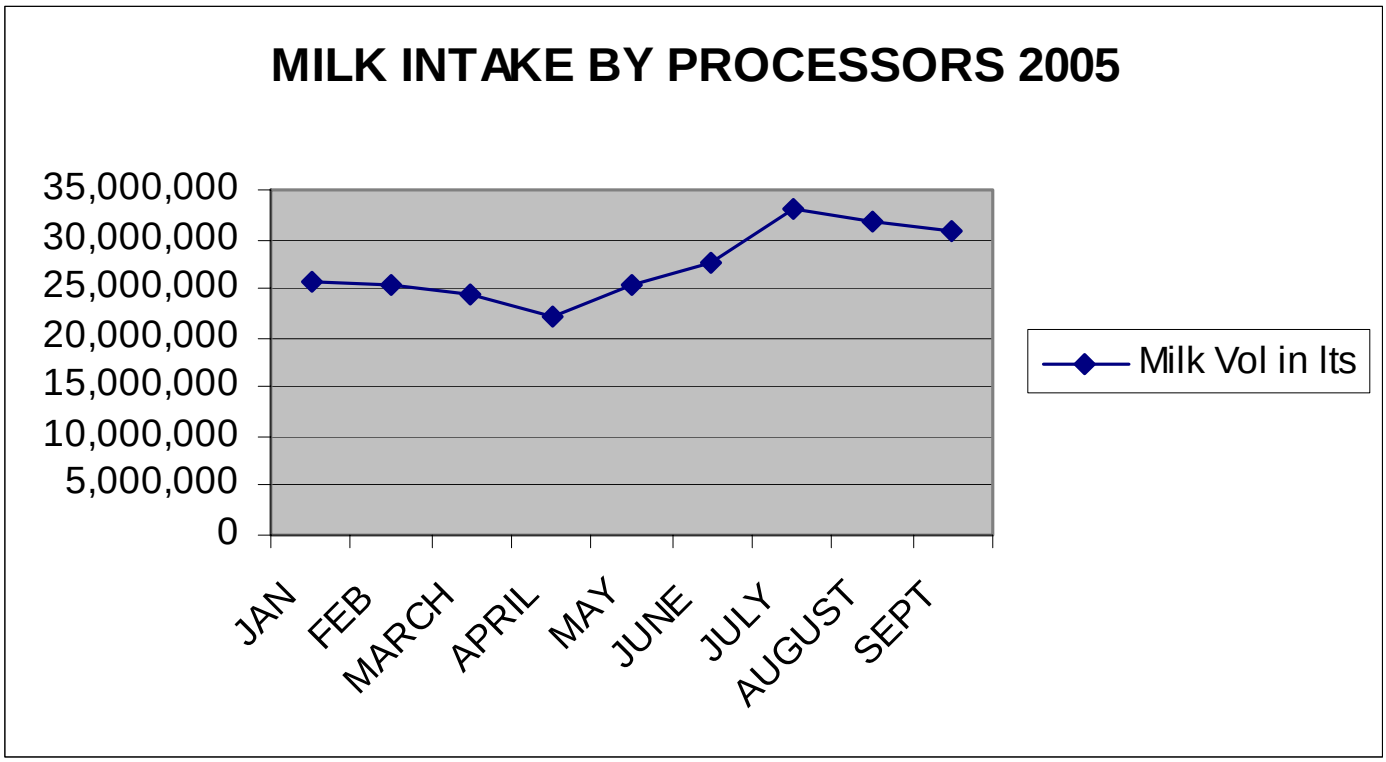
8. The Technological Challenges of the Kenyan Dairy Industry (Mr. Gichoi Macharia Managing Director of the Kenya Dail Board)

The Managing Director informed the workshop that the Kenya Dairy Board was established by an Act of parliament in 1958, under the Dairy Industry Act, Cap 336 of the laws of Kenya. Its main mandate is to develop, promote and regulate the Kenyan dairy industry. He noted that the Kenyan Dairy Industry contributes about 3% of the Kenyan Gross Domestic Product (GDP) and supports over 1 million smallholder dairy households. He informed the workshop that the sector generates 365,000 waged jobs and over 500,000 jobs in the support service. According to the Ministry of Livestock and Fisheries Development, the annual milk production in Kenya is estimated at 3.12 billion litres, with 1.8 billion litres being marketed.

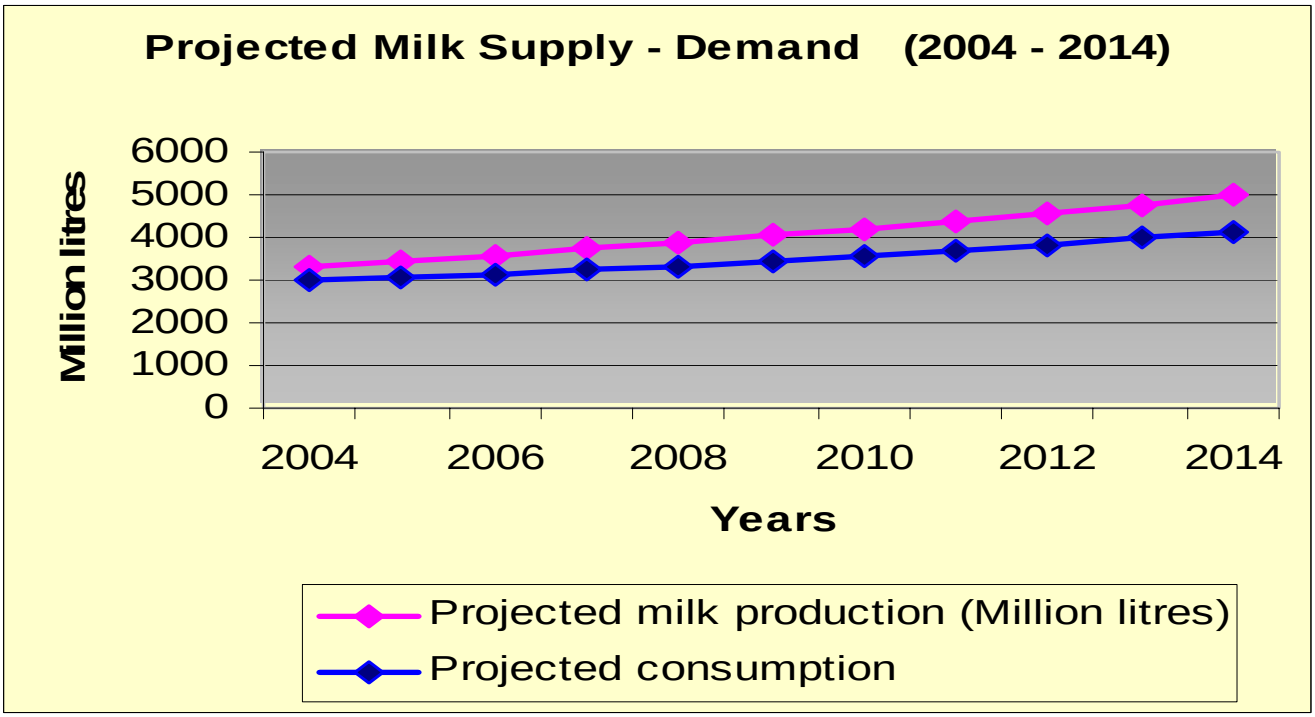
He noted that the Kenyan milk production is concentrated in the Rift Valley, Central and Eastern Provinces. He estimated cattle production at 11.5 million heads that are distributed as follows; Dairy 3.3 million and Zebu beef at 8.2 million. The average milk production for a dairy cow in Kenya is 1500 litres per cow per year. He presented a graph of the volume of processed milk from 1986 – 2004 as shown below.



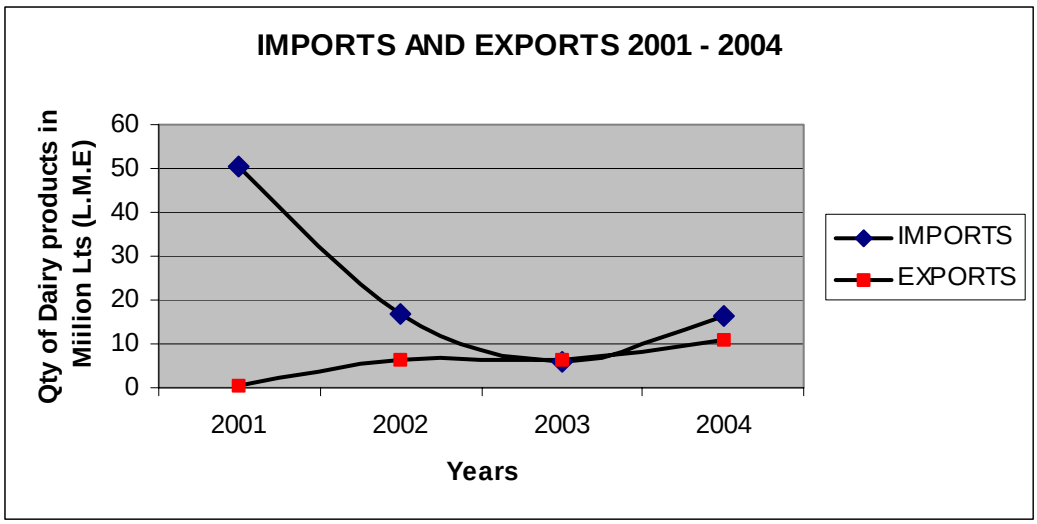
He further presented a graph of milk intake by processors in 2005 as shown below.



The projected milk Supply – Demand for 2004 – 2014 was presented as shown below.



The dairy imports were presented by the Managing Director to show a steady reduction since 2001 while exports have shown signs of picking up.



The Managing Director presented the statistics of the formal Kenyan dairy sector as consisting of 33 active processors (over 50 processors having been licensed since liberalization), 80 mini dairies with a maximum of 5000 litres per day, 55 cottage industries and 810 milk bars. Kenyan milk is processed into fresh milk, mala, yoghurt, ice cream, cheese, long life fresh milk, powder milk, butter and ghee. He observed that the installed Kenyan milk processing capacity stands at 2.9 million litres per day, but the country is presently processing about 1 million litres per day. The over 1 million small-scale producers use limited technology range in milk processing and production. Technology in terms of machinery, equipments and skills is advanced for large-scale Kenyan processors. He noted the use of simple equipments at cottage level, mainly fabricated by the informal sector. There is a limited number of suppliers for imported dairy equipments. Training and skills upgrading in the sector is being offered by local universities, polytechnics, DTI, and other middle level colleges.

Research in technology and related issues is being undertaken by KIRDI, KARI, ITDG, ILRI etc. He underscored the benefits of technology in the dairy industry as being:

- Increased productivity
- Enhanced efficiency
- Improvement in quality
- Product diversification
- Reduced environmental pollution
- Energy conservation
- Low production costs
- Enhances market access
- Minimising of post harvest wastages

He observed that for a prosperous and efficient dairy industry, efficient and affordable technologies are required in:

- Animal production and health
- Milk cooling
- Milk production
- Milk processing
- Milk packaging
- Quality control and assurance
- Adoption of quality management systems
- Adoption of Environmental and Safety Management Systems
- Waste management

He noted that the technological challenges in the Kenyan Dairy industry were:

- High costs of machinery, equipments and related supplies
- A large and segmented informal market that is a threat to the milk processing industry
- Limited skills especially in the informal sector
- Lack of appropriate and simple milk handing and processing technologies suitable for small and medium scale entrepreneurs
- Limited research into dairy technologies
- High post harvest losses due to limited milk cooling and preservation technologies
- Limited consumption of other dairy products except for the liquid milk
- Limited milk packaging alternatives that are cost effective
- Lack of well developed after sales services especially for some imported equipments
- High cost of milk processing which discourages investment in modern technology

Interventions to address technology gaps include:

- Enhance allocation of funds for dairy research and development
- Promote research into simple, appropriate and affordable equipment
- Promote credit provision to small and large scale entrepreneurs
- Industry should develop a clear and well defined policy and have a technology vision
- Enhance transfer of appropriate skills in the industry
- Enhance availability of after sales services
- Promote milk and milk products consumption in order to promote investment in the sector

He concluded by saying that technology is key to the growth of the dairy industry. He also observed further that recent studies show that the long-term growth of the industry will heavily depend on the availability of the export market. To capture this market, he said, Kenyans require to diversity on their dairy products and also strive to attain world-class quality standards. Technology will play a critical role in achieving this goal.

8.1. Dairy Sub-Sector TNA Findings

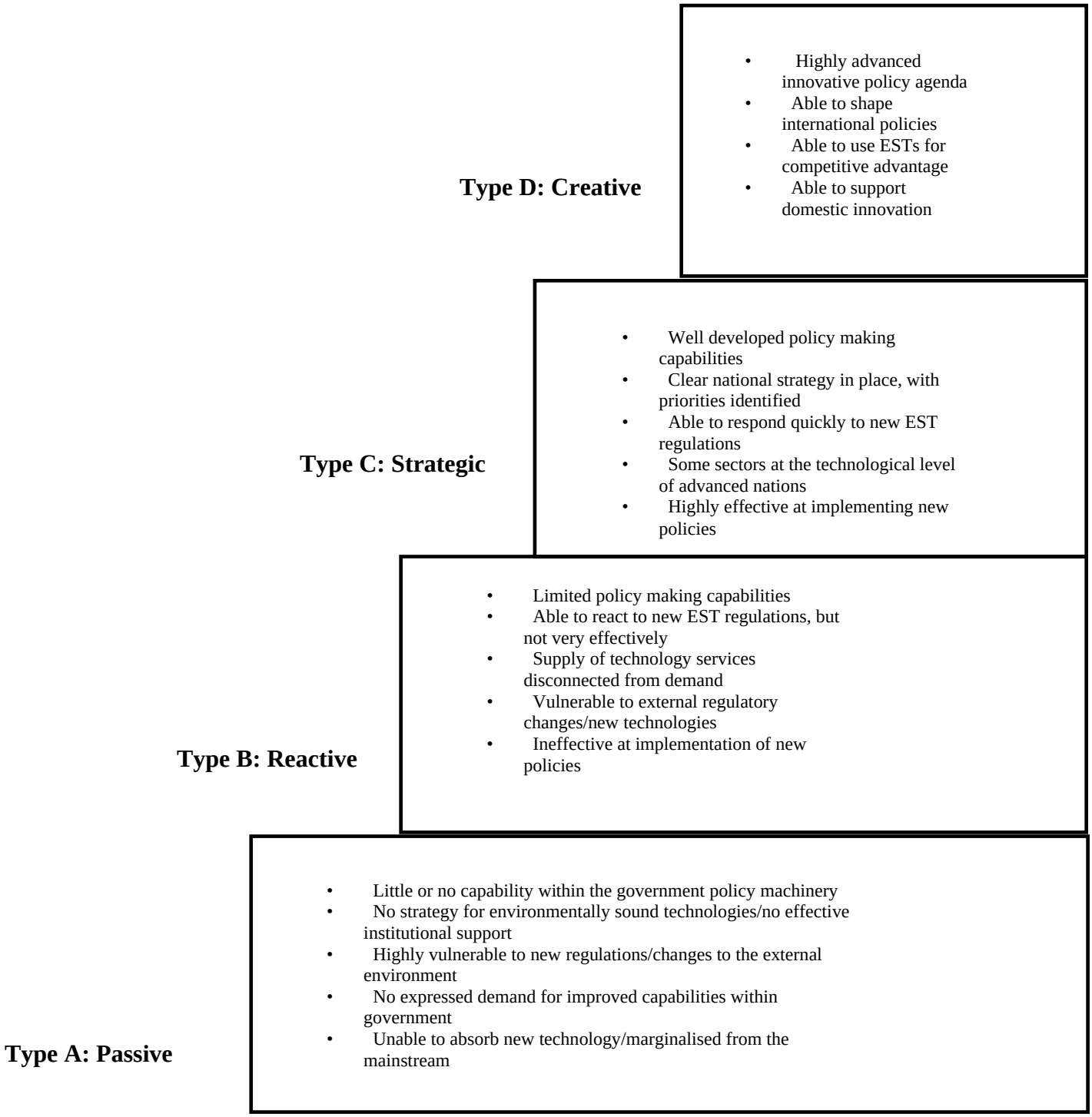
In order to be able to assess the technological needs for the Kenyan Dairy Industry, the TNA tool was applied to the following stakeholders, relevant Government Ministries, Sectoral Organizations and individual enterprises. The key aspects of the questionnaire were:

Policy Making – the ability of senior policy makers to recognize technological needs of the economy and be in position to strategise for its upgrading for purposes of ensuring that the economy remains competitive in the era of globalisation.

Policy Machinery – the existence of mechanisms for formulating and executing science and technology policy

Policy Performance – effectiveness and efficiency, by which policies are enacted, executed and evaluated.

Staircase Model of National Policy Capabilities in DCs



The same procedure was repeated for the coffee sub-sector. The Government findings were similar and are as stated below (as per the Staircase model above):

Policy Making – Reactive
Policy Machinery – Reactive
Policy Performance - Reactive
Further understanding can be obtained from the staircase model above.

8.2. Technological Constraints of the Dairy Sector

- Lack of simple, appropriate and economical milk preservation and cooling technologies
- Lack of quality control and/or enforcement of the ingredient requirements of different types of dairy feeds. Leads to milk supply fluctuations
- Limited incentives for marketing, quality control, and value addition for the Kenyan dairy industry frustrates the sector's ability to penetrate certain niche markets
- No reliable technology for identifying cattle breeds for purposes of developing accurate cattle census. The Kenya Stud book is not routinely updated
- Poor animal husbandry practices of keeping too many animals that produce less milk as opposed to having fewer and well taken care of animals that will produce better milk yields
- Weak enabling environment for technology sourcing, negotiation, licensing and transfer by the Government of Kenya
- Unreliable Artificial Insemination (AI) services in terms of breed specifications
- Inefficient milk collection, transportation and handling systems. A combination of technologies should be tested to shorten distance and time between collection and delivery to plant or consumers
- Expensive packaging materials
- Non-exploitation of indigenous technologies for milk preservation
- Ensuring quality control and assurance of milk received including minimum tests before accepting deliveries
- Costly equipment for processing dairy products forcing majority of players to rely on inefficient jua kali technologies
- Lack of access to information on new technologies, innovations and markets
- Inefficient R&D institutes and their disconnection from the needs of the dairy industry
- Inadequate human resources and mechanisms for expanding the milk processing product range
- Excessive post-harvest losses due to poor storage and modes of transportation
- Limited access to finance for purposes of technology upgrading
- Warranties for purchased technologies are not east to enforce in Kenya
- Limited awareness raising on the nutritional values of the entire range of milk products

- Unfair competition from unlicensed traders.

For the two Sub-Sectors, findings at the sectoral and enterprise levels were found to be strategic (as per the stair case model below). Most corporate in Kenya are operating within the framework of strategic plans. However, these strategic plans are not backed up with clear-cut programs and projects that are necessary if change has to be created. The interpretation of this is that sectors and enterprises posses a swift capability of responding to changes while the Government dose not possess that capability due to inbuilt bureaucracy.

9. TNA Background Presentation

Prof. Butler introduced the UNIDO TNA tool to the workshop participants. He elaborated on the importance of capacity building in the areas of technology and innovation management techniques. He explained in detail the functioning of the innovation uncertainty map and road mapping in technology management.

10. Plennary Discussions

Though with a focus on Dairy and Coffee the plenary sessions were based on three relevant Millennium Development Goals (MDGs) namely Goals 1, 7 and 8. The details and targets for these goals are as stated below.

(i) Goal 1: Eradicate Extreme Poverty and Hunger
(ii) Goal 7: Ensure Environmental Sustainability
(iii) Goal 8: Develop a Global Partnership for Development

It was clearly demonstrated that TNA can play a very important role in enabling Kenya realize its MDGs with specific relevance to dairy and coffee.

11. Recommondations

The workshop made the following recommendations:

1. Need for Awareness Creation and Training sessions that will target Government Departments, Research and Technological Organizations, Regulators and users of technology
2. Creation of a Technology Needs Assessment (TNAs) Secretariate to be co hosted by the Kenya Industrial Research and Development Institute (KIRDI) and the Kenya National Cleaner Production Center (KNCPC)
3. Expand the undertaking of TNA other sectors of the economy nationally and regionally under the framework of the East African Community (EAC)

4. Arrange for Interactive TNA Public Private Sector Consultations, dialogues and Collaboration for purposes of sensitizing the Government's Millennium Development Goals (MDG) team on the role of TNA in enabling the country realize its MDGs and the Ministry of Planning and National Development on the important role of TNAs in development policy formulation
5. Establishment and Maintenance of TNA networks nationally and regionally
6. Need to adapt the TNA tool to capture in a comprehensive way the feeling of the respondents on the ground. These feelings are key in the shaping of development policies
7. Inclusion of an Excel Sheet program in the tool to assists in quicker analysis of obtained results. Will make the tool user friendly
8. Undertaking of Research and Development on TNAs.

LIST OF PARTICIPANTS

NO	Name of the Participant	Title of the Participant	Name of the Organization
1	Eng. Nelson Maina Njeru	Production Manager	Thika Coffee Mills
2	Mr. Silas M. Kiragu	Snr. Deputy Director of Industries	Ministry of Trade and Industry
3	Ms. Jane Nyakang'o	Director	Kenya National Cleaner Production Centre (KNCPC)
4	Mr. Kelvin Khisa	Deputy Director	Kenya National Cleaner Production Centre (KNCPC)
5	Dr. MCZ Moturi	Deputy Director	Kenya Industrial Research and Development Institute (KIRDI)
6	Mr. Gregory M. Munyao	Deputy Director of Industries	Ministry of Trade and Industry
7	Mr. Machira Gichohi	Managing Director	Kenya Dairy Board
8	Mr. Nathaniel F. Makoni	Director	ABS TCM Limited
9	Dr. Edwin A. Okila	Project Coordinator	AMS TCM Limited
10	Mr. Paul Ndung'u	Technical Officer	Kenya Dairy Board
11	Dr. Paul B. Capstick	Managing Director	ANALABS Limited
12	Mr. Maclean Egesa Mang'eni	Dairy Processing Specialist	Land O'Lakes, Inc
13	Mr. Charles Obulloh	Assistant PRO and Sales	Kenya National Chamber of Commerce and Industry
14	Mr. Peter M. Ndonyo	Quality Assurance Manager	Githunguri Dairy Farmers Cooperative Society

15	Mr. Ng'ang'a T. Njurang'a	Production Manager	Githunguri Dairy Farmers Cooperative Society
16	Catherine N. Gitobu	Senior Technician (Research)	Kenya Industrial Research and Development Institute (KIRDI)
17	Mr. Paul Kihumba Mwangi	Committee Member	Githunguri Dairy Farmers Cooperative Society
18	Mr. Atsali Stanley	Patent/Trademarks Examiner	Kenya Intellectual Property Institute (KIPI)
19	Ms. Kaari Mundia	Consultant	Kenya National Cleaner Production Center (KNCPC)
20	Dr. Moses Makayoto	Chief Scientist	Kenya Industrial Research and Development Institute (KIRDI)
21	Prof. Jeff Butler	Research Fellow, PREST, Institute of Innovation and Research, (UNIDO Consultant)	Manchester Business School, University of Manchester
22	Mr. Josphat G. Mwangi	Production Manager	Palmhouse Dairies Limited
23	Ms. Ann M. Kiarie	Senior Industrial Development Officer	Ministry of Trade and Industry
24	Mr. Suresh Patel	Director	SAROC Limited
25	Mr. Kenneth W.O. Aduda	Principal Research Scientist	Kenya Industrial Research and Development Institute (KIRDI)
26	Ms. Faith Wanjiru	Coordinator	YADSTI
27	Mr. Duncan Ndegwa	Food Specialist	ANALABS
28	Mr. Arveson Khalagai	Intern	Kenya National Cleaner Production Center (KNCPC)
29	Ms. Naomi Gichiora	Administration	Kenya National Cleaner Production Center (KNCPC)
30	Ms. Jane Kamenwa	Administration	Kenya Industrial Research and Development Institute (KIRDI)

ANNEX III WORKSHOP REPORT ON TECHNOLOGY NEEDS ASSESSMENT FOR TANZANIA

REPORT OF THE FIRST NATIONAL STAKEHOLDERS' WORKSHOP ON TECHNOLOGY NEEDS ASSESSMENT FOR TANZANIA HELD AT COSTECH ON 16-17 JAN 2006

1. Introduction

1.1. Background

There has been little formal survey done to establish the technology needs of Tanzania. Only recently CoeT conducted a study on "Status and Needs of SMEs in Tanzania" Though the study uncovered the general needs and constraints facing SMEs it was not technology focused. As a result of lack of information on technologies to cater for their specific technology needs entrepreneurs and investors have been lured by market trends and there has been a replication of similar entrepreneurial activities without injecting new ideas.

Because technology needs of the country is not properly understood there has been no national priorities in technology development acquisition and transfer. For the same reasons generally research and development activities are not demand based, they are performed in an ad-hoc and uncoordinated way and no wonder they have remained on shelves for too long!.

Due to the above reasons the Tanzania Commission for Science and Technology (COSTECH) in collaboration with Small Industries Development Organization (SIDO) under the advise of UNIDO came-up with a proposal to undertake survey to establish the technology needs of Tanzania. The initial proposal was submitted to UNIDO for funding. However, despite her willingness to assist the project, UNIDO advised COSTECH/SIDO to first call a National Stakeholders' Workshop so as to enable participant's give their views that will enrich the proposal document.

In response to UNIDO's advice COSTECH/SIDO convened a national Stakeholders' Workshop on 16 – 17 January 2006 comprising of policy makers, entrepreneurs and government representatives and public and private sector. 35 participants attended the workshop. UNIDO sponsored a Consultant who facilitated the workshop from UNIDO Head quarters.

1.2. Workshop Objectives

The overall objective of the workshop was to get Stakeholders' views on the country's technology needs and appropriate transfer methods for achieving comprehensive results.

Specific objectives:

- To promote the technology transfer and development of appropriate and sustainable technologies for social-economic development.

- To learn from UNIDO consultant the Technology Needs Assessment (TNA) methodology.

- To consider how and where the methodology should be applied in Tanzania

- To determine what might be needed to support its introduction and diffusion in particular application areas

1.3. Why TNA?

- To identify possible actions to effect technology transfer and innovation at a national, regional, or sector level

- To promote a culture where technology transfers opportunities are identified and seized more readily by local entrepreneurs.

- To be able to prioritize resources and target technology transfer according to observed levels and patterns of capabilities and country priority sectors.

1.4. Expected outcomes of the workshop

The workshop was expected to come up with the following: -

- Presentation and discussion of the UNIDO tools and methodologies for technology transfer particularly UNIDOS TNA methodology

- Identification and priotization of sectors, which are critical for the National Development as a focus for Technology transfer.

- Advice on formulation and prioritize strategies for technology transfer.

- Identify opportunities.

- Decide where we want to get in the future (foresight).

- Come up with a National Proposal document that will be used to solicit funds for conducting the exercise and finally

- Advice on the suitability of the UNIDO TNA methodology and tools with the aim of improving and adopting it as necessitated by country specific needs and conditions.

2. Lessons from opening Remarks and Statements by invited Guests

The stake holder's workshop provided a forum different invited Guests to give their views and guidance on issues related to the country's technology needs and transfer.

Those who gave registered value adding advice include, Mr Felix Ugbor (UNIDO country representative), Mr Mteleka (The Director of Techno-ministry of science technology and higher learning), Mr Chijoriga (acting Director General COSTECH), and Dr Raphael Matheo (The Director Centre for Development and Transfer of Technology)

In his welcoming remarks the Director General of COSTECH pointed out that the world today is largely dependent on Science and Technology for sustainable socio-economic development and that S & T are essential components for wealth creation and technology development and transfer has been responsible for the fast growing economies of Japan and South East Asia.

He advised workshop participants to come out with recommendations that will enable the Technology Need assessment to be successfully implemented including resources mobilization.

The Director of the Centre for Development and Transfer of Technology in his introductory remarks said the country is not yet empowered to fully-realize its potentials in terms of technology generation (development), acquisition, dissemination and utilization despite having abundant resources.

This has contributed significantly to the country's lag especially in industrial production and related outputs.

He further reminded the participants that one of the contributions of the UNIDO to the implementation of the Agenda 21 during the World Summit on Sustainable Development (WSSD) in Johannesburg (26 August – 4 September 2002) was the development of the TNA frameworks for the Developing Countries.

He said that there was need to carry out TNA in Tanzania and that COSTECH and SIDO have developed a document (a first draft) to justify the need to carry out the TNA for our country. . We intend to adopt and customize the UNIDO's method to suite our needs. "That is why we have the UNIDO's TNA expert with us here today to guide us". He was very grateful to UNIDO for facilitating the expert and footing some of the workshop costs. It is our anticipation that, Technology Needs Assessment (TNA) framework that will be developed in these two days will facilitate and guide Technology Transfer by Identifying and Prioritising available and required Capabilities for sustainable technology Transfer", he said.

Finally, he thanked the UNIDO – Country Representative Mr. Felix Ugbor for this guidance on how to proceed with this very important exercise. I would say, probably without his aspirations we might not have called this workshop.

While giving the UNIDO statement, Mr. Felix Ugbor said that UNIDO was happy to collaborate with the national authorities in organizing the workshop which he believed was an important beginning for Tanzania's quest for growth as specified in the national development framework, MKUKUTA. He said that the creation, transformation and management of knowledge on industry could be considered a global public good, which is legitimate concern of UNIDO. This covers areas such as the transfer and upgrading of technology, learning, innovation, building of skills and capabilities, which have direct bearing on productivity growth.

In order to help developing countries, he said, UNIDO has developed guidelines for technology needs assessment which are country driven activities that support the identification of technology priorities of a country and assist in the implementation of technology transfer strategies and that the intervention on Technology Transfer. Assessing Needs – Promoting Action which was developed by UNIDO and agreed upon at the World Summit on Sustainable Development in 2002 aims at strengthening the institutional capacity of the developing countries in assessing technological capabilities and needs and helping them to develop capability based technology upgrading programs at national, sect oral and enterprise levels. At the same time it aims to foster technology cooperation, especially south-south cooperation, among participating countries.

He said that Technology needs assessment framework is targeted at three levels:

1. At national level, TNA. Focuses, on technology policy formulation and execution capabilities at the macro level, to verify the existence of a national technology strategy, a base of existing capable firms, appropriate research and technology organizations and effective policy-making bodies.
2. At sect oral level, it focuses on assessing the performance of sectors in relation to what is happening in other parts of the world:
3. At enterprise level, the aim is to provide a detailed approach to auditing technological capabilities in selected sectors.

"Naturally, the needs assessment is best undertaken with the active involvement of the key stakeholders in the concerned country. We are thus happy to see a large number of specialists, practitioners and more importantly institutions whose roles are critical in designing the strategy for technological development in the country", he reiterated.

He recognized the presence of Prof. Jeff Butler, UNIDO Consultant who was present, as a resource person to present the UNIDO tools and methodologies for technology needs assessment. He advised the Participants to feel free to suggest any modifications they believe will be best suited to Tanzania's need

because the workshop was an opportunity for participants to identify the barriers to technology transfer and to suggest measures and actions to overcome those barriers. "Eventually, the exercise of technology needs assessment should provide support for the development of a coherent national technology strategy in support of competitiveness, economic growth and environmentally sustainable development" he said.

He finally assured the participants that UNIDO would continue to support local initiative, which enhances technology transfer. *"We will provide the necessary support during the implementation of the TNA action plan that should be the outcome of this tow-day workshop"*

He hoped that the forum would provide an opportunity for all the concerned institutions to work much more closely in identifying the bottlenecks and the solutions for technological advancement of Tanzania.

The Director of Science and Technology in his opening speech began by saying that the workshop has come at an opportune time whereby our Country was in the process of implementing the Millennium Development Goals and her Vision 2025 aimed at sustainable development and poverty reduction.

In order to achieve MDGs Technology Transfer must play a very crucial role as declared in Agenda 21 and the G-77 Summit because the fast development of the Tiger Nations in the Far East is due to well-articulated Technology Transfer programmes.

He said that the Government has formulated policies and supported technology transfer issues and thanked the organizers COSTECH, SIDO and UNIDO for organizing this workshop and for the financial contributions as paying way for implementation of Government policies.

He wished the workshop a success and to be a corner stone for the identification and assessing of the technology needs capabilities for eventually establishment of sustainable Technology Transfer Management in the Country.

3. Paper Presentation

Paper 1: A report on the Status and Needs of SMEs in Tanzania

Was presented by Prof.H. Katalambula

The presentation basically was showing the results obtained from the survey , which was conducted, by TGT and CoET in 2002 to 2004,also include the problems in which SMEs are faced with and the common solutions to overcome these problems.

The following are some of the points from the presentation.

- The problems faced by SMEs from the findings includes: Use of outdated technologies, lack market for their products, lack of adequate working and investment capital, most SMEs are informal and under performing in many cases. The survey they discovered that SMEs needs modern machinery, market and investment capital

  The report highlights some suggestions on ways of overcoming technology related constraints facing SMEs such as;

- Establishment of Technology/Business Incubators

- Establishment of clusters and SMEs clubs

- There is a need to determine type and level of technology needed at SMEs level. This justifies the need to undertake the TNA.

From the presentation it became clear that lack of appropriate technology is one of the major problem constraining the development and competitiveness of SMEs in Tanzania

Economic vs. Technology status in Tanzania

In this session the professor katalambula from the college of engineering and Technology of the university of Dar Es salaam gave a presentation on economic Vs Technology status in Tanzania. The presentation highlighted the role of technology and its contribution to the country economic development. The following are some points from the presentation

- Tanzania economy is still dependent on agriculture and counts for over 50% of its GDP.
- Tanzania capital GDP is $210
- Agriculture provides 75% export and employ 85% of the total work
- Tanzania economy is not supported by local technology instead foreign dominated technologies.
- Technology led to improve competition globally
- SMEs in Tanzania constrained by finance, managerial skills, technical skills, and appropriate technology, in adequate entrepreneur skills and poor infrastructure service.
- Market is important to stimulate technology to economy.
- Developed technology should be identified and disseminated to the end user.
- To enable science and technology play their leading role, the Government will carry out a comprehensive review of the position in this area and ensure that all R&D institutions are rationalized, synchronized and consolidated by providing adequate financial, expertise, support incentives and other necessary infrastructure facilities.

Paper 3: Some basics of TNA

Was presented by Prof. Jeff Butler – UNIDO Consultant

The UNIDO Consultant professor Jeff Butler gave a technical presentation. His presentation was interactive in nature and followed by open discussion from the participants focusing on issues related to the application of the UNIDO TNA methodology.

Professor J Butler introduced important aspects of TNA in relation to technology development and transfer. He analyzed the components in technology particularly its impact, needs analysis, TNA approaches, principles, technology providers perspective, national perspective and the role international agencies like UNIDO can play in promoting technology development and technology transfer activities.

His presentation focused on areas highlighted below:

- Technology categories, techniques, information and know how.

- Complex sophisticated advanced technology is already in use even in developing countries like satellite TV, mobile phones, computers, catamarans, Boeing and Airbus, etc - so technology transfer does not seem to be a problem.

- A major problem is finding a viable economic or business model to support the widespread use of technologies. (IPR agreements and levels of education and training among technology developers users and promoters.0

- Government departments and agencies may select technology, by trade or industry associations, by research and technology institutes, by enterprises or groups or networks of companies, by a supply chain or a collaborative project, or by consumers.

- Consumers are becoming more and more important factor causing influences on technology choice.

- Supply-chain and value-chain relationships may mean that technologies chosen for us may have good or bad impact.

- New technology is needed to improve business performance, to deliver greater customer satisfaction, to stimulate a regional or national economy and also to make industrial sector more competitive – regionally, nationally or internationally – and this will help foster cooperation.

- Technology need analysis is a process to decide what technology might be useful in various situations or for specific purposes.

- TNA approaches are; Foresight and technology audit, technology assessment (engineering, environmental, legal, and socio-economic perspectives), technology and business strategy formulation ('market decisions'), simple technology and innovation management.

- TNA principles are stakeholder participation, 'user needs' analysis, competitive intelligence, technology management (e.g. QFD) Innovation management concepts, recognizing economic and business trends and global dynamics, diffusing and decentralizing responsibility to address complexity and detail.

- Technology acquisition is for sustainable economic development and not just for industry sector or enterprise development.

- If common technology needs can be identified in several countries or across continents then technology development and technology transfer activities can be negotiated more efficiently.

- International collaboration can be facilitated – north south or south or pan-African or organized by applications and not just technology or industry.

- Requests for support can be evaluated and prioritized more easily if it is known that local or regional stakeholders are well organized and resources will therefore be used effectively

- The aim of TNA is not only to identify areas of weakness and difficulty, which need to be addressed. It also needs to capture the potential 'dynamic comparative advantage'

  The presentation of Professor Butler was an eye opener as it stimulated hot discussion on the position of Tanzania in the stair case model. After the presentation and through analysis of some filled questionnaires, it was generally realized that our country position in a star-case model is REACTIVE (Type B) therefore there is a need to climb to TYPE C: Strategic and then move CREATIVE MODEL

3.1. General Discussion

After listening attentively the discussion from invited guests, presentations from local experts and an ably done interactive presentation from Professor Butler, the participants had the following contributions to make:

- TNA should be conducted for the purpose understanding the technological needs of the country, uncover the technology gaps to be filled, and asses the technical and managerial capabilities and gaps to

be filled in the processes of capacity development. It should not be regarded as only a tool for creating a databank.

- It was argued that currently, the economy in the country is supported by imported technology rather than local technology. Local technology development base should be strengthened through encouragement of innovations

- Regarding sources of technology for economic development, it was urged that there are two sources namely; technology transfers from abroad and home born technology. It is important to support growth of technology in the country whether locally developed or imported. R&D activities, technology sourcing and transfer must be linked to enterprise needs and should be industrial driven.

- It was discussed that there are two scenarios regarding the linkage between technology and economy, namely technology based economy and economy based technology. When inquired as to which group has Tanzania adopted in order to advance its technology, there was no straight answer.

- It was noted as a challenge that the country's economy depends greatly on agriculture. Nevertheless the technology in agriculture is not advanced. Primitive techniques are used. TNA should strongly address this area

- It was argued that efficiency of technologies in the country could be improved if the researchers take opportunity to add value to the already existing inventions.

- It was discussed that researchers should be encouraged to use patent documentations for their researches.

- It was discussed that technology transfer does not seem to be a major problem, but the problem is finding a viable economic or business model to support the wide spread use of technologies.

- The forum was used to identify sector which in the views of the stakeholder would be given priority in technology as they are quick win sectors especially in employment creation and poverty reduction drive. The identified sectors:

    1. Agriculture and Livestock
    2. Manufacturing (SME- Focused)
    3. Mining
    4. Tourism
    5. Energy and environment
    6. ICT

The participants urged to follow the advise of UNIDO country representative Mr. Felix Ugbor on selecting priority sectors and sub-sectors that should form the priority areas of focus in our search for technological development. Mr. Ugbor also urged the organizers to pursue the implementation of the TNA rather than putting the report on shelves in order to speedup the technology transfer action.

4. Recommendations

After the interactive discussion from the participants the following recommendations were advanced.

1. The UNIDO questionnaires (Sector and firm Level) need to be tailored to address the specific needs according to our priority sectors .An expert in developing such tools has to be engaged.

2. TNA should be conducted to at least 2 – 3 pilot regions first and observe the progress instead of extending all over the regions at once. The success realized from the pilot case the can be up-scaled to other regions.

3. The UNIDO consultant recommended that we should use the UNIDO methodology as the bridge to TNA implementation in Tanzania because it has the international quality and internationally accepted.

4. Also UNIDO consultant recommended that still on our way to implement TNA we need to have more discussions with more other stakeholders so as to exchange more ideas to reach better results, therefore on the progress more practitioners, specialists and more importantly institutions whose role are critical in designing the strategy for technological development in the country should be involved in one way or another to provide an opportunity for all institutions to work much more closely in identifying the bottlenecks and the solutions for technological advancement of Tanzania.

5. Write proposal and solicit fund from National strategy for economic and growth Fund. Locally known as MKUKUTA.

6. The proven research results from the R&D institutions should be released for commercialization, which recognized as one of the possible measure to overcome the barriers to technology transfer.
7. The result of the TNA should be made public so that many stakeholders including the private sector can participate in bring the country’s technological development using the TNA results

5. Way Forward – Action Plan for TNA Implementation

- Develop a tailored questionnaire based on discussions from the workshop by **15th April 2006 (a consultant has already been engaged)**

- Apply the questionnaire to selected regions and sectors and present the pilot results to stakeholders **15th May 2006**

- Finalizing and enriching the framework document: 15th June

- Submitting the framework document and soliciting of funds to development partners i.e. UNIDO, NGOs, Government, SMEs etc30th July 2006**.**

- Follow up activities after securing of funds:

    - Perform the TNA country wide

    - Analysis and report writing

    - Stake holders meeting to present the findings

    - Beefing up the report to incorporate stakeholders comments

    - Implementation of agreed activities on technology transfer according to the result of the TNA.

    - Identify key technology needed and liaise with technology providers

    - Develop effective way of technology transfer based on uncovered needs and in collaboration with local and international technology providers

    - Continuous monitoring and Evaluation

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ANNEX IV REPORT BY UNIDO CONSULTANT

Implementing the UNIDO methodology for Technology Needs Assessment (TNA)

Report by Jeff Butler, UNIDO International Consultant.
January 2006

1. Introduction

The UNIDO Technology Needs Assessment methodology was presented to representatives from several countries in a 5 day workshop in Dakar, Senegal in May 2005. The delegates were enthusiastic to apply the methodology in their own countries.

In order to build on that enthusiasm and to support and pilot the implementation of the methodology, workshops were subsequently organised between November 2005 and January 2006 in four countries: The Phillipines, Indonesia, Kenya and Tanzania. Each workshop was a two day workshop with between 30-60 participants. Each workshop was based on a template that was adapted to local circumstances. Each workshop involved government, industry and enterprise representatives.

This report summarises the lessons learned from the short series of workshops so that the UNIDO methodology can be introduced and applied in a wider range of countries. It also considers what further might be needed in each of the above four countries so that technology needs assessment processes can be more firmly established. Each country will make its own report and recommendations on actions which are specific to that country. This report considers what is needed to apply the UNIDO methodology more widely and what can be done to promote international cooperation in its application. In addition this report addresses several objectives for TNA including the international challenge of meeting the Millenium Development Goals. Each country has its own objectives for technology needs assessment.

2. The purpose of technology needs assesssent

Technology needs assessment is a process to identify where and how technology can be used more effectively so that suitable technology solutions can be found or developed. Technology transfer or the external acquisition of technology or collaborative projects can then be negotiated for each important technology need..

Technology needs assessment can be focused

(i) on the current needs of the economy (including industry, public services , infrastructure and environmental projects)

(ii) on the future expected needs of the economy assuming no significant strategic interventions but anticipating product and process innovations
(iii) on technologies which will support strategies for sustainable economic growth
(iv) on solutions to address environmental issues
(v) to better address the Millenium Development Goals.

Focus (v) was the original reason for developing the UNIDO TNA methodology.

In the four countries in which workshops were organised the default requirement for TNA appeared to be purpose (i). The workshops and the UNIDO methodology can therefore be used to stimulate a catalytic effect and to accelerate progress towards the improvement of living conditions and the national economy.

3. Participation in the workshops

There are government departments in all four countries that are responsible for technology audit, technology assessment and technology planning etc. There are also centres for cleaner technology and promoting sustainable development, including UNIDO centres, in some of those countries. It is not known if there are departments or teams in any of the countries which have the specifc responsibility to consider the Millenium Development Goals. It is preferable when identifying opportunities and contacts to introduce the UNIDO TNA methodology that the potential to use it in the above five ways should be explained so that workshop organisers and participants can be briefed accordingly and the workshop can be promoted for each explicit purpose.

The choice of focus might influence the selection of participants and it could be decided to organise two or three smaller and more focused workshops for these different objectives

In all four workshops an event was organised which usefully assembled a range of participants across the three levels - national, sector and firm level. The majority of participants were from government departments responsible for technology analysis and strategy, except in Kenya where there was a stronger representation from the two sectors in which surveys had been conducted (coffee and dairy sectors) and where the agency promoting the application of TNA was a cleaner technology centre. The RTO in which that centre operated was also closely involved in organising the workshop.

The UNIDO TNA methodology is based around a self assessment procedure – simple questionnaires at each of the three levels. The questionnaires can be circulated to potential respondents in various combinations of these three levels. It was a discussion point to consider how suitable respondents should be identified. Related to this discussion are questions about the statistical significance and interpretation of responses.

In three of the four countries pilot exercises to collect responses to the questionnaires had already been conducted and the responses, and how to analyse the results, were discussed in the workshops. Based on this discussion there are some typical questions which can be anticipated in any future exercises in other countries. The guidance that can now be provided, based on the experience of discussions in these workshops will help all countries to better identify an appropriate sample size and composition.

All workshop were conducted in English without simultaneous translation except that group discussions adopted the national language. In Indonesia at the request of the consultant the questionnaires had been translated into the national language. In general there was a very high level of English comprehension and discussion.

4. The agenda of the workshops

Each workshop was based on the same template. Information about the economy of the country and/or sectors would be presented by relevant keynote speakers. The UNIDO TNA methodology was introduced by the UNIDO international consultant and group discussions would then be organised to discuss the methodology and how to plan for its application(s) at national, sectoral and firm levels. In some cases these discussions focused on the kinds of technologies that might be needed in each sector so that a deeper understanding could be gained of the complex range of ways in which technology is used, and how innovation opportunities can be identified.

The workshops aimed to generate action points and recommendations for TNA planning and implementation that were unique to each level and situation. The workshops also served to discuss the merits of the UNIDO TNA methodology in particular and how other techniques might need to be used alongside. There was often some misunderstanding about the utility of the UNIDO methodology. Most workshop participants expect a TNA methodology to be focused on the analysis of technology systems and not to be focused on the management capabilities that enable technologies to be developed and utilised. The UNIDO methodology is not a technique for assessing technology needs within enterprises or to address specific problems. Instead the UNIDO methodology assesses the management capabilities of the organisational systems that will identify and introduce technology solutions.

Part of the objective of a workshop was to explain and promote the general need for TNA since there would be participants who were not familar with its potential benefits and indeed needed to be convinced that it did have value. In this respect the visibility and profile of the workshops was important and it was helpful for the TNA champions (i.e the local workshop organisers) to be associated with a UNIDO technique, a UNIDO sponsored event, the availability of an international consultant, prior experience of workshops in other countries, and the international launch of a methodology. All of these dimensions raised the profile of the methodology and the workshop . It was recognised that there could be some international benchmarking and collaborations about TNA applications and approaches.

In two out of four workshops there was a local UNIDO representative who had been invited by the local organisers and who made a presentation and participated in discussions.

It was also occasionally useful during workshops to explain to participants what had happened in previous workshops and to transfer useful ideas and approaches.

Variations in the agenda of workshops were mainly embedded in discussion group topics and included the following:
1. the topics chosen for discussion groups and how they were determined – in some workshops these were pre determined and in other workshops they were identified by a creative workshop discussion process, facilitated by the consultant.
2. a sectoral focus and case study approach instead of just a national perspective
3. a focus on adaptation of the methodology

In two workshops the consultant was the overall facilitator and steered discussion in certain directions. In the other two workshops the discussion topics were determined by a locally appointed chairman and in one case the overall progress of discussions was facilitated by a locally appointed professor. In three out of four workshops the group discussions were arranged in corners of the main room. In the fourth workshop there were parallel rooms. In all cases the acoustics of the room were poor quality and so discussion sometimes was difficult to follow. Participation could therefore be more difficult for those group members who were not naturally outspoken.

The consultant had indicated in advance that there should be cross fertilisation of ideas between parallel groups using ‘network managers’. Three volunteer participants in each group were asked to assume the roles of Chairman, Rapporteur and Network Manager. This approach meant that the groups were interdependent and not just working in isolation in anticipation of plenary presentations. This approach also accelerated discussions towards the overall workshop objectives – planning for the development of TNA approaches and deciding how and where the UNIDO methodology should be applied.

The approach reinforced the message which the consultant promoted that the UNIDO questionnairre surveys do not need to be organised just within a national or sector or firm level but can also usefully be organised across the interfaces between these three levels.

Plenary discussions were then used to assemble the ideas and information generated in groups. In one workshop the local organisers had arranged for video and audio recording as well as written notes by secretaries. In that workshop two computers and projectors were used in parallel during the plenary discussion to capture on one computer ideas and action points whilst viewing rapporteurs’ presentations on the other computer. This was an

effective approach, facilitated by the local organiser, which can be recommended for future workshops.

5. Topics chosen for group discussions

Where there were no pre-determined discussion topics shown on the agenda there was sometimes preliminary anxiety and confusion about the likely achievements of the workshop. The reason for suggesting this approach was to allow groups to focus on topics which they regarded as problematic in their particular context. TNA in general and the UNIDO methodology in particular can be targetted at specific application opportunities. These may not be known in advance but emerge after the purpose and benefits of TNA have been explained.

In one workshop the groups were structured around topics which were important problems in that country – e.g. integrated transport in cities, waste management, and energy policy. In another country the groups focused on: the problems of SMEs and how to support them through TNA and how to organise for TNA amongst SMEs; the needs of one particular sector (the furniture sector) and its strategic plans; high impact uses for TNA in the economy; and a 'no-name' group. This latter group had a remit to consider whatever it thought most important for TNA application. The juxtaposition of these four topics was especially creative and the enthusiasm and focus of all the groups was commendable. The high impact and no-name topics were especially useful and both these discussion topics attracted a high proportion of the most senior managers within the workshop. They encouraged a strategic planning perspective for economic development which counters the usual tendency of participants to focus only on current technology needs.

If this strategic planning perspective is not adopted the full potential of the UNIDO methodology will not be released.

In another workshop the local organiser suggested that group discussions focus on the Millenium Development Goals. All four discussion groups were asked, for one session, to consider how the MDG could be addressed in that country. This request surprised the consultant, especially since that workshop has adopted a strong sectoral focus (coffee and dairy sectors). The consultant had previously assumed that planning to address the MDG was a top down exercise. However this focus proved to be very useful and each group quickly identified relevant opportunities. From those opportunities, areas where technology needs should be identified could then be prioritised.

In the fourth workshop, where a local facilitator had been appointed, the three groups were selected (not volunteers) and were instructed to focus on either the national, sector or firm level and to answers several specific questions. Each group pursued its own topic from late afternoon on day 1 through to lunchtime on day 2. Amongst the designated tasks set for each group was a request to carefully examine the UNIDO questions and consider how they might need to be adapted.

Variations between the workshops were also introduced because in one country there was already a strong interest in TNA and regionally dispersed teams had experience in applying TNA techniques at the enterprise and sector levels. In another workshop, TNA was centralised within two government departments. These departments collaborated in the design of the workshop; one has responsibility for environmental technologies and sustainability and the other has a strategic technology development responsibility (e.g. via technology audit and foresight)

In another country the equivalent strategic planning department was represented in the workshop but in that country it was a small government department with several responsibilities including science and tehnology education planning. It was recognised that this department did not have resources to promote or plan TNA and so an alternative TNA implementation strategy needed to be considered.

In the fourth workshop it was firmly believed that the science and technology commission had the responsibility to promote the application of TNA via recommendations for a government policy. The UNIDO consultant did not fully agree with this top down approach since he also, in principle, sees potential for TNA empowerment at sectoral and firm levels.

The UNIDO methodology is based around assumptions that different organisations at each level – national, sector and enterprise levels – should interact easily in order that technology and innovation networks are promoted and effective. This assumption derives from innovation systems concepts. Where there is a need for strategic intervention to energise a sector (so that it begins to think about technology needs) the UNIDO methodology can be used as a catalyst. It should be in the interests of enterprises and sectors to engage in some technology needs assessment without that effort being part of a government TNA programme.

The extent to which the responsibility for TNA can be decentralised or dispersed, and the extent to which it is business driven, community driven, problem or issue driven or government driven raises questions about the purposes and benefits of TNA, the various roles for technology and what the UNIDO methodology emphasises.

The consultant introduced three technology and innovation management techniques in each workshop so that these questions could be better appreciated.

IT is believed that these three techniques usefully complement the UNIDO methodology. They can be used to plan more systematically how and where the UNIDO methodology can be applied and they can also be used to follow through initiatives created by the UNIDO methodology. They facilitate analysis of complex systems (such as business organisations and supply chain networks, or public services and infrastructure) and the characteristics of technology development and innovation projects. They can themselves be

regarded as TNA tools and techniques – part of a TNA toolkit. The three techniques are:

1. The Innovation Uncertainty Map, which is a 2x2 matrix which allows groups, teams and managers to analyse the characteristics of a project or a portfolio of projects and the strategies for managing those projects
2. $IDEF_0$, which is a method for analysing complex activities and systems such as R&D and innnovation projects or enterprises and communities in which problems need to be solved and innovation and technology needs identified
3. Strategic roadmapping. This technique introduces a future target or vision that it is decided should be achieved. It might be associated with a particular policy objective including the MDG. It then invites roadmapping participants to submit relevant information in several strata so that the targets can be achieved and the interconnections between strata and interdependencies between necessary projects or technologies can be examined systematically, even when disruptive external effects have occurred.

Most workshop participants see technology needs analysis as an engineering or technology focused technique. They see its purpose being to select the most appropriate technology that is available for a defined problem. They do not typically see that innovation is often driven by marketing and organisational factors and that technology evolves to meet those innovative requirements. There is a tendency to assume that technology can be acquired, probably from an advanced economy, and this might discourage creative thinking or innovative problem solving that would lead to projects for indigenous solutions. At the same time there is usually a desire to negotiate more easily with technology providers and to find more appropriate technologies (including more environmentally friendly and sustainable solutions) but such negotiations might have missed the full scope of innovation potential.

In order to appreciate the potential of the UNIDO methodology and why it focuses as it does on management capabilities and networking, it is useful to explore the roles of technology in an economic or innovation system and not just in a production system. It is also useful to think about a strategic roadmapping approach to economic and technology planning. The better an organisation or network might be at technology and innovation management (i.e the higher up the UNIDO TNA stepladder it is positioned) the more easily it should be able to approach problems and TNA opportunities with a creative style and hence the more likely should be the recoigntion of innovation potential.

6. The roles of technology

Technology can be used in many different kinds of problem situation. There are therefore many different categories of technology need to be identified and assessed.

Technology can be used, for example, in businesses, in public sector organisations, to address social and economic problems etc.

Technology is evolving, sometimes quite rapidly. Even advanced technologies such as RFIDs and space technology can have direct and economically viable applications in developing countries. Mobile telephones, the internet and applications such as google and ebay have immediate and direct benefits. Some of these applications are diffusing with their own momentum but in addition some creative thinking by appropriate groups can identify solutions to important problems such as water shortages, waste management, pollution and disease. These kinds of problems are ubiquitous but efforts to address them are not organised effectively. TNA can help to create more efficient organisation to address these problems. It can prioritise resources and prevent duplication of effort. This can sometimes be arranged at an international level. UNIDO exploits this opportunity using a variety of schemes and mechanisms. The promotion of TNA is an additional mechanism for UNIDO activity.

There are three levels of solutions:

1. Technology can be used to make current operations more efficient.

2. Technology can be used to facilitate innovation in existing operations so that systems are upgraded

3. Technology can be designed and developed to meet anticipated future needs.

These three levels imply respectively that opportunities to improve operational efficiency can be recognised, that innovations can be identified which have technology implications, and that a strategic vision of future needs can be presented. In all cases an opportunity might be recognised but the solution may be very challenging. Thus the difficulty of the technological and innovation challenge needs to be represented. In some cases a technology need might be identified where it may be two or three or more years before a solution can be found or developed. In the case of medecines and vaccines it can of course be many years before solutions can be found. In some infratructure problems or where the problem is geographially dispersed there may already be easy and affordable technology solutions but it is logistically difficult to make those solutions accessible in a short period of time. In such cases there may be a decision to seek alternative technologies which can more readily be distributed or there may be a search for technology to support the distribution or logistics problems.

The Innovation Uncertainty Map, IDEF, and stategic roadmapping can all be used to help analyse these kinds of situations.

There may be education and training reasons why a particular solution cannot be quickly utilised. Innovative or technology based solutions to that education and training requirement might therefore become a focus of attention. Not all

of these kinds of technology opportunities can be considered by central government teams. There are too many opportunities, an often detailed specialist or local knowledge needs to be applied.

TNA thus becomes a way of focusing management attention and creative thinking on problems and opportunities.

So technology needs assesssment is more than a technical decision-making process. It is more than choosing the optimum technology solution. It is a creative process.

Innovation is often more successful when user needs are clearly identified and when users are involved in the process, before particular technology solutions are proposed. Needs pull is more likely to be successful than technology push.

Because there are so many different types of situations where technology might be useful it is preferable to decentralise the assessment process.. This implies a training and awareness programme or better still a learning process that is integrated with the technology and innovation management activities.

For this learning process to be stimulated certain conditions are necessary in the culture and value systems of the networks and communities where TNA will be promoted.

So TNA is a process – a learning process - not just a technique. The UNIDO methodology aims to assess and monitor the conditions for learning to take place. If a targetted sample of respondents score more highly on the UNIDO TNA stepladder (which grades from ‘passive’ through ‘reactive’ and ‘strategic’ to ‘creative’) then that group of respondents and the systems and networks in which they operate will find technology and innovation easier to plan and facilitate. They will be more aware of outside solutions and potential and that will stimulate and crystalise a desire for improvements and procedures and the capability to scan for solutions and implementation support.

The more highly a target group scores (whether it be national sector or firm level, or determined according to multidisciplinary problem solving requirements) the better that group should be at technology and innovation management and THEREFORE the better it should be able to engage in TNA processes. In addition, because of the structure of the questions, the better that group should be at making decisions and judgements on environmental and sustainability issues and ensuring that these are embedded within TNA activities. Moreover, the higher the ‘UNIDO stepladder score’ across a wide range of groups and sectors the more easily TNA can establish an independent momentum and accomplish broader and deeper analyses. With highler levels of technology and innovation management capability the higher should be experiential learning from projects, so there is a multiplier effect into the future, and the easier should be the negotiation and successful accomplishment of technology transfer since technology and knowledge absorption should be easier.

By providing an index or audit of technology and innovation management capability the UNIDO TNA methodology decentralises TNA prospects and empowers sector and firm level participation in TNA. Government departments with science, technology, management and education responsibilities can better prepare and encourage this devolved TNA activity. Government departments with health, transport, pollution, waste and other responsibilities can also leverage the potential of TNA. Thirdly, the departments with economic development and strategic planning responsibilities can also utilise TNA. The three types of departments should ideally coordinate their respective activities into a coherent TNA strategy.

Unfortunately, because the word technology is present in the term TNA the full potential as just outlined is probably not realised. TNA is more likely to be regarded as a technique which is focused on technology specifics within clearly defined parameters. The same fate has inhibited the use of strategic roadmapping in many companies in advanced economies and so experts' advice now is not to call roadmapping 'technology roadmapping' which does not tend to attract and involve financial, marketing and strategy managers as it should do, but better to call it 'strategic roadmapping' or simply 'roadmapping'.

The concept of Millenium Development Goals usefully overrides this functional management attitude or constraint and the specific challenges which they address invites a truly multidisciplinary TNA approach. It will be especially useful, since the MDG are very challenging and demanding, if TNA can be introduced alongside or in the context of creative and innovation management. Technology development can flourish in creative and innovative environments.

Thus the workhops did not simply explain the structure of the UNIDO TNA methodology and its questionnaires and stepladder model but also emphasised how good effective TNA depended on innovative and sometimes visionary thinking. Secondly by planning systematically to identify a wide range of technology applications within complex organisations, systems and networks, many more technology and innovation opportunities can then be addressed. The greater the number of oipportunities that need to be evaluated and the wider the range the more valuable is a decentralised TNA process and the greater the level of intellectual resources that will automatically be dedicated to the task. When managers and RTO staff are practising good technology and innovation management they should also (by definition) be engaging informally and instinctively in TNA related tasks. This can be aligned with strategic TNA exercises organised a anational level.

There are additional benefits if an audit of technology and innovation management capability is conducted and if that audit has a sustainability dimension. It can facilitate international discussions and informal benchmarking to promote better TNA. It can stimulate interactions which will help identify and negotiate south–south or south-north collaborations, and it can align exisiting TNA resources with the Millenium Development Goals,

raise the profile of TNA activity, and emphasise strategic sustainable development and not just operational effciency. These are exciting and important opportunities. Moreover they are attached to practical methods.

Conclusions and recommendations

These can be presented simply and concisely.

The workshops were a valuable experience to learn better how to introduce and support the UNIDO TNA methodology. They were also useful profile raising exercises for TNA methodologies within each country.

They were opportunities to adapt the UNIDO methodology and to consider how, when and where to implement it. Suggestions for ways to encoruage international collaboration in TNA support were also emerging from the workshops and deserve further attention.

In each country there is a need for further support and these recommendations can be pursued individually using appropriate channels.

In order to make further progress in rolling out the UNIDO TNA methodology to other countries the author of this report considers that it is not necessary and probably not ideal to organise workshops which are similar in scale and design to these four workshops. They pose signicant organisational challenges and costs for the local organisers, which UNIDO only partially supported, and they require effort to be concentrated into two intensive days. The ability to absorb information, carefully examine sophisticated questions and adapt them to national circumstances and the range of topics and sectors that need to be considered suggest that a smaller taskforce team approach might be preferable. This team can work over a prolonged period and thus sustain the effort more reliably. It can consult different sectors and problem areas. It can work with several government departments etc. It can learn and practice the three technology management techniques that have been introduced and apply these to prority opportunities. There could be several taskforce teams in each country. There could be a network of teams in several countries with UNIDO support for collaboration. There is already significant expertise availale in certain countries. Some taskforce teams could be specifically targetted at the Millenium Development Goals.

This suggestion needs further development and refinement. One requirement, for example, is to decide how to identify and appoint appropriate members to such teams, the composition of teams, the duration and intensity of work, and the expected outcomes. All of these are important, but relatively easy to discuss. It is proposd that the initial remit of such a team would not be more extensive than to prepare a strategy for applying TNA, considering and adapting the UNIDO TNA methodology and as an exercise applying TNA to the Millenium Development Goals. The amount of work involved would be comparable to the effort expended by a larger number of participants in a two day workshop, but the workshop itself would not need to be organised. Instead a smaller meeting for six to ten people could be planned. The

discussions would be more flexible, informal and direct (no keynote speakers required etc). In some countries a one day workshop could be planned for 6 – 10 participants who will all be expected to join the task force team. In another country a two or three day workshop might be planned for three taskforce teams of similar size – each will work independently and in parallel on different objectives. The resoruces required even for three teams is still less than for a 40 -60 person workshop and the discussions and follow up actions can be more specifically determined.

There is a sense of urgency and a taskforce team approach could perhaps be rolled out faster in several countries and with more definitive outcomes than a large workshop approach. The four workshops that have recently been organised depended on local organisers who were champions for the cause, who were in a position to invite and involve other government departments and sectoral and firm level participants. They had also all participated in the Dakar workshop and so had some familaroty with teh UNIDO methodology. The taskforce team approach as it is envisaged here would reduce the initial dependency on the availability of such individuals and their induction/training period.
Discussions between proposed taskforce teams and with UNIDO and any appointed consultants could be organised on a flexible basis so that a greater variety of possible implementation strategies could be developed, if customisation was required by each country. Where there are local UNIDO representatives available or where there are other UNIDO (Vienna) staff interested in innovation matters there would be a greater potential to develop interactions with these taskforce teams.

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