Axel Paulsch, Thomas Kamp, Gernot Bäurle and Thomas Plän (Eds.)

Technology Transfer via the Clearing-House Mechanism (CHM)

- A national study on actors, instruments, possible concepts and perspectives for the German CHM to facilitate technology transfer and cooperation in support to the Convention on Biological Diversity -

Federal Agency for Nature Conservation

BfN – Skripten 160

2005

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Cover Pictures: Photos by courtesy of Prof. Dr. Thomas Speck, Botanical Garden Freiburg, Germany.

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Photo right: *Dendrocalamus giganteus* aus: T. Speck, N.P. Rowe & H.-Ch. Spatz (1996): Pflanzliche Achsen, hochkomplexe Verbundmaterialien mit erstaunlichen mechanischen Eigenschaften. - In: W. Nachtigall & A. Wisser (Eds.), BIONA-report 10 - Technische Biologie und Bionik 3. Akad. Wiss. u. Lit. Mainz: 101 - 131, Stuttgart (Fischer Verlag).

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This publication is included in the literature database "*DNL-online*" (www.dnl-online.de)

BfN-Skripten are not available in book trade.

Publisher: Bundesamt für Naturschutz (BfN)
Federal Agency for Nature Conservation
Konstantinstrasse 110
53179 Bonn, Germany
URL: http://www.bfn.de

Printed by the printing office of the Federal Ministry of Environment, Nature Conservation and Nuclear Safety.

Printed on 100% recycled paper.

Bonn, Germany 2005

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1 Summary

Background: COP 7 of the CBD (February 2004) adopted a work programme on Technology Transfer and Technological Cooperation that describes the main task of the Clearing House Mechanism (CHM) in its function as an information system. According to this Technology Transfer (TT) is understood as transfer of technologies - hard and soft - on a public or private level that are in the public domain, protected, or derived from traditional knowledge. (Chapter 2, page 6)

Aim and course: The present study has the aim to identify actors, methods and instruments of transfer of respective technologies in Germany. Furthermore, concepts are to be developed on how the German CHM can fulfil the tasks with respect to TT set by the work programme. During the course of the study, an internet based inventory was performed, participants of the UN conference in Trondheim in 2003 were additionally interviewed, the national thematic reports of Parties to the CBD were analysed and national experts were summoned to workshops twice. (Chapter 3, page 8)

Thematic areas: As a first attempt to explain the term 'biodiversity related technologies', the authors propose a division into eight thematic areas: biotechnologies, bioresource technologies, bionics, ecosystem technologies, biodiversity sound technologies, technologies for the implementation of CBD thematic work programmes, CBD crosscutting issues, and the CBD ecosystem approach. These thematic areas are illustrated by examples. (Chapter 3.2, page 9)

Actors in Germany: In Germany, a multitude of hundreds of different actors is participating in TT in varying intensity and from different perspectives. On the federal level, the Ministries for Science, Technology and Education (BMBF), for Economic Cooperation and Developmemt (BMZ), of Consumer Protection, Food and Agriculture (BMVEL) and for the Environment (BMU), as well as the Federal Agencies for Environment (UBA) and for Nature Conservation (BfN) are most active in bidiversity related TT. On the level of federal states, there are also many specific TT institutions. With respect to international technology transfer in the development sector, the Gesellschaft für Technische Zusammenarbeit (GTZ) including its GATE- Initiative (German Appropriate Technology and Ecoefficiency Programme) is the most important institution. (Chapter 3.3, page 12)

In the sector of public research many associations and foundations are active in worldwide TT (e.g. Helmholtz-Association, Fraunhofer-Association, Science Association Gottfried Wilhelm Leibnitz, Max-Planck Association, Steinbeis-Foundation or German Research Foundation DFG). More than 40 German universities have built up their own contact offices for TT. In the private sector 81 chambers of commerce plus chambers of foreign trade and industry institutions are active in TT. In the NGO sector, TT is done by foundations, environmental organisations, institutions of churches and of development cooperation (e.g. Alexander von Humboldt-Foundation, Deutsche Bundesstiftung Umwelt, Forum for Environment and Development, Volkswagen foundation, Daimler-Benz-Foundation, 'Misereor' or 'Brot für die Welt'). Just to name a few of a large number the study exemplarily presents leaflets of six initiatives of the different sectors in more detail: GATE, Cleaner Production, Bayern Innovativ, RUN, IDCED und SES.

The actors in Germany use strategies of different intensity, including passive information offers, voucher systems, customer or product oriented information platforms, or active brokerage between holders and potential users of technologies. The strategies

used have to be adapted to the target group as the ability to get access to information differs between users / recipients. For effective TT via the CHM a combination of strategies would make sense and existing structures would have to be integrated and expanded.

Trondheim Conference: The Norway/UN Conference on Technology Transfer and Capacity Building (June 2003 in Trondheim, Norway, organised by the Norwegian government and UNEP) was taken as an opportunity for collecting international participants comments. The answers to a questionnaire distributed at the conference and prepared by the authors of the study and the official conference report reveal that information about technologies in the public domain should be provided more properly, that processing of and access to existing information are urgently needed and that development policies and biodiversity policies should be better interlinked. (Chapter 3.4, page 29)

National Reports: The existing national reports on TT submitted by the Parties to the CBD Secretariat (answering rate about 15%) were also analysed for the study. The focus of the answers given is on TT via governmental or public institutions. Mentioned as factors limiting TT, are the lack of institutional capacity and expertise, limited financial resources, and missing access to information and training. Only six out of 188 Parties provide an explanation on how they use their CHM for TT. The CHM is seen only as passive information platform. (Chapter 3.5, page 31)

Expert Meetings: During the course of the study two national meetings with national TT-experts were organised. The statements given by the participants were assigned to the themes of the CBD work programme on TT. (Chapter 3.6, page 34)

With respect to information systems it was emphasised that information offers (data banks, question-answer-systems) need permanent updating and cause permanent costs. Since approximately 98% of TT develop via personal contacts the CHM would have to foster these personal contacts. Catalogues of competence can also lead quickly to direct contacts between holders of technologies and potential users.

With respect to needs assessment it was stated that an analysis of the market situation should be performed to make selling of own products a realistic option. A needs assessment has to be scientifically based, should investigate the needs of local populations and should not rely exclusively on governmental information only, since experiences from the past show that technologies are sometimes selected according to funding possibilities and not according to real needs.

With respect to capacity building the experts emphasised that technologies should be offered as a package, including handling instructions, repair information, and adaptations to local conditions. Investments have to be financially feasible which often needs small credits. Providing help for the development of national TT-strategies is seen as one possible way of knowledge transfer and capacity building.

With respect to enabling environment it was remarked that in many cases it is not the existence of patents for some highly advanced technologies that hinders TT, but the insufficient level of capacity and training for the use and implementation of technologies in the public domain.

Implementation Instruments: The study provides an overview over implementation instruments used in TT and lists many examples. These instruments include: e.g. data

banks, web boards, chat rooms, news letters, list servers, tool kits, fairs, workshops, technology markets, mediation contacts, contact fairs, networks, and technology clusters. (Chapter 3.7, page 37)

Action-Oriented Recommendations, Scenarios: As an integration of the results and findings action-oriented recommendations in three scenarios for the implementation of the tasks of the CHM are developed and instruments are assigned. From the first to the third scenario the complexity of tasks for the CHM is increasing, as well as the number of instruments proposed. Each scenario performs a step to a higher level of quality compared to the previous one. In the first scenario, the CHM forms an information platform and thus fulfils its task foreseen in programme element 2 of the CBD work programme on TT.

Since a passive information platform alone is not sufficient to initiate successful TT, a step to a higher level of quality is performed towards Scenario II: here the CHM acts additionally as partner and moderator of a national network of biodiversity related technology transfer of competence. Basic structures and contact persons for such a national network of competence for biodiversity related technologies already exist via the expert meeting initialised during the study, which makes the second scenario an ambitious but realistic option for the future of the German CHM. In a further step to an even higher quality level the CHM in Scenario III takes a promotion function as active TT-manager, who fosters contacts between technology holders and users by active brokerage. This would be a new dimension for a fundamentally enlarged CHM towards a facilitator of 'matchmaking' partnerships. (Chapter 4, page 43)

Action-Oriented Recommendations, Target Group: Finally the study proposes that biodiversity related TT via the CHM should give a special focus on the target group of rural populations and local communities in developing countries and should foster the transfer of technologies that are in the public domain. Integration of the experiences of organisations in development cooperation would be essential, since these organisations have direct contact to the target group. The study recommends for the near future to summon a workshop on the national level in order to initiate a network of competence with actors form TT and development cooperation.

Further options for the German CHM could include fostering access to selected technologies, e.g. in the field of genetic pollution - in cooperation with the BCH (Biosafety Clearing-House) - or in the field of caps and trade with certificates. In both fields developing countries need technologies for sampling and monitoring which often are not freely accessible. (Chapter 4.4, page 47)

2 Course of the Study

The Parties to the Convention on Biological Diversity (CBD) consider information about and transfer of biodiversity related technology as an important field. The ninth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) in November 2003 prepared a work program on transfer of technology and technology cooperation, which was adopted in February 2004 by the seventh Conference of the Parties (COP 7). The Clearing-House Mechanism (CHM) was expected to play a key role.

Regarding this background the German Federal Agency for Nature Conservation (BfN) with funds from the German Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) assigned a study 'Technology transfer via the CHM' in Germany. In order to provide an overview of the present situation of TT in Germany the study should give answers to the following issues: 1) which German actors exist in the field of transfer of biodiversity related technology (TT), and 2) which strategies, methods and instruments are used. Since this situation is under permanent change, the study can only provide a snap shot analysis. Based on this survey concepts are presented on the future role of the German CHM aiming at the fulfilment of TT related tasks and describes perspectives and potential areas that could be covered.

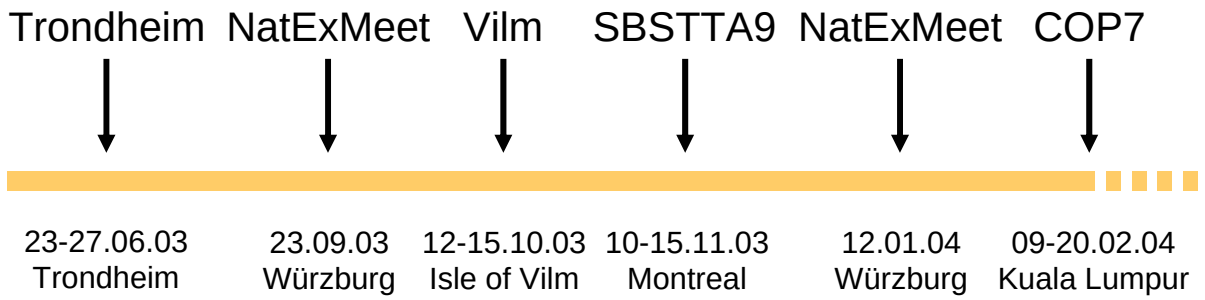

Figure 1 Milestones of project development

The authors of the study introduce the request for the CHM resulting from the CBD work program on transfer of technology and technological cooperation. The term 'biodiversity related technology' includes a wide range of technologies. The authors propose to categorise these technologies into eight provisional thematic areas, each of which is illustrated with an example from German TT. Based upon an intensive internet based enquiry, the results reveal that a multitude of German actors participates in TT from various perspectives and with different intensity. The most important actors from the public sector, public research, the private sector and non-governmental organisations (NGO) are described as well as basic strategies of TT.

From this multitude of actors, national experts where invited twice to national workshops. The key statements and experiences from these workshops are presented in the study.

At the international level during the Norway/UN Conference on 'Technology Transfer and Capacity Building' in June 2003 in Trondheim, Norway participants were invited to fill in a questionnaire regarding experiences related to TT in the respective home countries. These questionnaires and the thematic reports on TT which were submitted by the Parties to the CBD Secretariat are also included in the collection of experiences underlying this study.

Thus, the first part of the study describes the present situation of transfer of biodiversity related technologies with respect to thematic areas, actors, strategies and instruments, illustrated by various examples.

Based on the information and experience described in the first analytical part of the study the second part of the study develops three scenarios for the implementation of the requests to the CHM related to TT resulting from the CBD work program. These scenarios, which build on each other, list tasks and instruments.

3 Enquiry and Investigations for Technology Transfer

3.1 Request to the CHM resulting from the CBD Work Program

With decision VII/29[1] the seventh Conference of the Parties (COP 7, Feb.9.-20.2004 in Kuala Lumpur) adopted '*a programme of work on technology transfer and technological and scientific cooperation*', which should be implemented in close relation to the other thematic programs and cross cutting issues of the CBD. In the adopted work program the CHM is mentioned as a central gateway for information systems (compare Scenario I in Chapter 4.1, page 44) which are important for the implementation of Articles 16-19 of the CBD:

- Access to and transfer of technology (Art. 16)[2]
- Exchange of information (Art. 17)[3]
- Technical and scientific cooperation (Art. 18)[4]
- Handling of biotechnology and distribution of its benefits (Art. 19)[5].

The work program on technology transfer consists of four program elements:

- ***Technology assessment***[6]*:* Technology needs, the potential benefits costs and risks of such technologies, and the related capacity-building needs of Parties are identified in response to national priorities and policies.

- ***Information systems***[7]*:* National, regional and international information systems for technology transfer and cooperation provide comprehensive information of relevance to foster technology transfer and technology cooperation.

The role of the CHM is primarily seen in program element 2 (information systems).

- ***Enabling environment***[8]*:* To identify and put in place institutional, administrative, legislative and policy frameworks conducive to private and public sector technology transfer and cooperation, taking also into account existing work of relevant international organisations and initiatives.

- ***Capacity building and enhancement***[9]*:* Technical, scientific, institutional and administrative capacity is adequate for the effective cooperation, transfer, diffusion and adaptation of technology as well as technical and scientific cooperation.

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[1] *www.biodiv.org/decisions/?dec=VII/29*

[2] *www.biodiv.org/convention/articles.asp?lg=0&a=cbd-16*

[3] *www.biodiv.org/convention/articles.asp?lg=0&a=cbd-17*

[4] *www.biodiv.org/convention/articles.asp?lg=0&a=cbd-18*

[5] *www.biodiv.org/convention/articles.asp?lg=0&a=cbd-19*

[6] *www.biodiv.org/programmes/cross-cutting/technology/assessment.asp*

[7] *www.biodiv.org/programmes/cross-cutting/technology/systems.asp*

[8] *www.biodiv.org/programmes/cross-cutting/technology/enabling.asp*

[9] *www.biodiv.org/programmes/cross-cutting/technology/capacity.asp*

The role of the CHM is primarily seen in program element 2 (information systems) (compare scenario I in Chapter 4.1, page 44). According to this program element, the CHM should provide access to information about relevant technologies, including their accessibility, technical parameters and economic and social aspects. Information on patents (holders and timeframes), model contracts and legal aspects of TT should be provided. Additionally, the CHM should inform about identified technology needs of Parties, case studies and best practice examples for means and methods for the creation of favourable enabling environments for TT and technological cooperation (compare scenario II in Chapter 4.2, page 45).

The program distinguishes between public transfer (between governmental institutions) and private transfer (including a private enterprise as a partner).

Technologies can be

- from the public domain
- protected, and
- derived from traditional knowledge.

3.2 Thematic Areas of Technology Transfer

Technology transfer in the sense of the CBD includes the transfer of soft and/or hard technology. Soft technology is defined as technological information, knowledge, experience or skills (e.g. which medical plant can be used to cure which disease). Hard technology is defined as machines or gear (e.g. solar panels or a sewage treating facility).

TT includes the transfer of a wide range of soft and hard technologies.

Since the term biodiversity related technology covers a wide range, the study presents a first proposal to cluster the technologies into eight thematic areas, which might in parts overlap.

Suggested biodiversity related thematic areas for technology transfer:

Biotechnologies are technologies that capitalize on the attributes of cells or biological molecules, such as DNA and proteins. They comprise any technological application that uses biological systems, living organisms, or derivatives thereof. This includes also technologies dealing with genetically modified organisms (GMO), e.g. 'Gene Usage Restriction Technologies' (GURTs) (compare Box on page 10).

Bioresource Technologies use genetic resources or materials from plants or animals. In the form of providing food and clothing these technologies are the oldest form of using bioresources in human history. This thematic areas also includes all technologies that deal with renewable primary products.

Bionics tries to derive construction principles from natural systems and use them for the improvement of technical products or systems. The copying of the self-cleaning capacity of plant surfaces (the so called 'Lotus effect') for artificial surfaces is an example for bionics.

Ecosystem-technologies use technical equipment for ecosystem management. This requires profound understanding of ecosystem functioning. This thematic area covers planning methods, restoration measures or the conception of life support systems.

Biodiversity Sound Technologies protect biodiversity, are less polluting, use biological resources in a more sustainable manner, recycle more wastes and products and handle residual wastes in a more acceptable manner than the technologies for which they are substitutes. They contribute to biodiversity conservation by relieving natural systems from pressure.

Technologies for the implementation of CBD thematic work programs try to measure and conserve biodiversity in the respective ecosystems. This includes methods for data collection, monitoring or e.g. development of climate or flooding scenarios.

Technologies for the implementation of CBD cross-cutting issues include monitoring and evaluation of possible risks from the release of genetically modified organisms or invasive or introduced species. Transfer of knowledge about sustainable use is also included in this thematic area.

Technologies for the implementation of the ecosystem approach of the CBD cover scientific skills for ecosystem research and ecosystem management as well as methods for implementing benefit sharing.

Used Forms of Biotechnology

The Organisation for Economic Co-operation and Development (OECD) defines biotechnology as application of science and technology on living organisms, parts or products thereof, and models, in order to change living or non-living material to the production of knowledge, goods or services. The application possibilities of biotechnologies are very broad and at least in the German speaking countries a further categorisation of biotechnologies got common:

- Green Biotechnology changes plants in order to optimise their characteristics or transfer new characteristics.
- Red Biotechnology includes medical applications form diagnostics to therapies.
- White Biotechnology uses biological compounds for the optimisation of industrial processes.
- Blue Biotechnology focuses on technical use of processes and organisms from marine biology.
- Grey Biotechnology focuses on environmentally sound processes and on efforts to use biotechnology for the protection of the environment.
- Yellow Biotechnology is sometimes defined as biotechnology in food production or the production of chemical ingredients.

Table 1: Examples for thematic areas and their connection to the four program elements of the CBD work program on technologie transfer and technological cooperation from German institutions.

Thematic Area	Content	Partner	TT connected to			
			na	is	ee	cb
Biotechnology	Improvement of wood characteristics by manipulating filaments[1]	• University Göttingen		X		
Bioresources	Conservation and use of wild coffee varieties in Ethiopia[2]	• Centre for Development Research (ZEF) • Ethio Coffee and Tea Plantation and Marketing Private Ltd Company, Ethiopia • Oromia Coffee farmers cooperative Union Ltd., Ethiopia		X		X
Bionics	Shark skin saves energy[3]	• Department of Turbulence Research of the German Aerospace Centre (DLR) • 3M GmbH • Cathay-Airways		X		
Ecosystem-Technologies	Grassland-Management in Argentina[4]	• Centre for Environmental Reserch Leipzig (UFZ) • International Office of BMBF • Centro regional de Investigaciones Cientificas Mendoza, Argentinia	X	X	X	X
Biodiversity sound Technologies	Providing solar panels to communities in Nepal[5]	• Fachhochschule Stuttgart • Himalaya Light Foundation (NGO in Nepal)	X	X		X
Technologies for the implementation of CBD thematic work programs	Method from Burkina Faso for restoration of degraded soils in Niger[6]	• Centre for Development Research (ZEF) • International Crop Research Institute for the Semi-arid Tropics ICRISAT, Niger	X	X		X
Technologies for the implementation of CBD cross-cutting issues	Creating of a independent information system for sustainable land use[7]	• RuNet in German Centre for Documentation and Information in Agriculture (ZADI) • Agricultural Research Council South Africa (ARC) • Institut des Recherches Agricoles du Benin (INRAB)	X	X		X
Technologies for the implementation of the ecosystem approach of the CBD	Reference system for evaluation of forest fragments[8]	• BMBF • Fachhochschule Cologne • Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Brazil	X	X	X	X

*Note:
na: needs assessment
is: information systems
ee: enabling environment
cp: capacity building

[1] *www.holz.uni-goettingen.de/deutsch/forschung.html*

[2] *www.coffee.uni-bonn.de*

[3] *www.bionik.tu-berlin.de/kompetenznetz/industrie/referenzen.html*

[4] *www.internationales-buero.de/arbeitsfelder/wtz/Amerika/Argentinien?pro=YES#apList*

[5] *www.fht-stuttgart.de/fbp/fbpweb/sonstiges/nepal.shtml*

[6] *www.wocat.net/MATERIALS/NigerOttBenguerel.pdf*

[7] *www.runetwork.de*

[8] *www.tt.fh-koeln.de/blumen*

3.3 Technology Transfer in Germany

Successful technology transfer usually starts with a personal contact between a holder and a potential user / recipient of a technology. This contact can be spontaneous or managed. Through a consulting process and in many cases personal visits the real need is assessed and recommendations for an implementation are provided. If necessary the technology is adapted to local conditions and ideally the knowledge to handle the technology independently is also transferred.

In Germany, a multitude of actors participates in all steps of TT from various perspectives and with different intensity. In the following chapters the most important actors from the

- public sector
- public research sector
- private sector and
- NGO sector

are described.

A multitude of actors participates in all steps of TT from various perspectives and with different intensity.

3.3.1 Public Technology Transfer Institutions

Several Federal Ministries and their agencies contribute actively to TT. The **Federal Ministry for Science, Technology and Education** (BMBF, *www.bmbf.de*) together with the **Institut der deutschen Wirtschaft Köln Consult GmbH** (*www.iwkoeln.de*) participates in a so-called '**Innovation Market**' (*www.innovationmarket.de*). The Innovation Market has been set up in order to systematically bring together highly promising ideas, capital and companies and lead to a better implementation and use of high quality inventions. The BMBF also founded the project INSTI (**INnovations-STImulation**, *www.insti.de*) in order to stimulate innovations and make use of patents.

On the federal level BMBF, BMU, BMZ, BMVEL, UBA and BfN are most active in biodiversity related TT.

Important instruments for international cooperation of the **Federal Ministry of Consumer Protection, Food and Agriculture** (BMVEL, *www.bmvel.de*) are twinning projects within EU programms.

The **Federal Agency for the Environment** (UBA, *www.uba.de*) set up the internet portal **'Cleaner Production Germany'** (CPG, *www.cleaner-production.de*). This portal provides information on the implementation of environmentally sound technologies available in Germany and services for environmental issues. The portal **'Energy Germany'** (*www.energy-germany.de*) lists technologies, contacts, funding programs and companies related to climate protection.

The **German Agency for Nature Conservation** (BfN, *www.bfn.de*) hosts the German CHM (*www.biodiv-chm.de*) to which the present study provides options for further development of biodiversity related national TT activities.

The **Federal Ministry for Economic Cooperation and Development** (BMZ, *www.bmz.de*) in 2005 used a budget of nearly 4 billion Euros for credits, donations or

technical assistance to partner countries to ensure equal development chances, fair benefit sharing, protection of environment and conservation of natural resources.

There are also many TT institutions at the level of the 16 federal states or 'Laender' in Germany, e.g. the **Technologie-Netz Bayern** (*www.tt-netz-bayern.de*), the **Technologiestiftung Berlin** (*www.technologiestiftung-berlin.de*), the **Zukunftsagentur Brandenburg** (*www.zab-brandenburg.de*), the **Technologiestiftung Hessen** (*www.tsh-hessen.de*), the **Technologieagentur Niedersachsen** (*www.nati.de*), the **Technologie-Transfer-Zentrale Schleswig-Holstein** (*www.ttzsh.de*) or the **Stiftung für Technologie- und Innovationsförderung Thüringen** (*www.stift-thueringen.de*).

The main cooperation unit in international TT is the government-owned **Deutsche Gesellschaft für Technische Zusammenarbeit** (GTZ, *www.gtz.de* **German Society for Technical Cooperation**). Its goal is to enhance the capabilities of people, organisations and institutional structures in the partner countries. Technical Cooperation means transferring knowledge and skills and improving the conditions for their use. Technical Cooperation strengthens the individual initiative of the people so that they can improve their living conditions through their own efforts. The **GATE-Initiative** (**German Appropriate Technology and Ecoefficiency Programme**, *www.gtz.de/gate*) as part of the **GTZ** provides an information service on the adaptation and dissemination of technologies (GATE-ID), regional NGO cooperation (GATE-NGO), small scale project fund (GATE-SSPF) and coordination service for appropriate building technologies (BASIN). With some countries (e.g. Argentina, Brazil, China, Indonesia) the German government has established scientific-technical cooperation contracts with many technological joint projects also in the biodiversity realm.

3.3.2 Technology Transfer Institutions in the Public Research Sector

In the public research sector more than 40 universities installed contact offices for TT. Many universities founded associated institutes[1], collecting societies or foundations (Schmoch *et al.*, 2000[2]). Technical colleges are also active in technology and knowledge transfer.

The **Helmholtz-Gesellschaft** (HGF, *www.helmholtz.de*), which is a joint society of 16 big research establishments takes part in TT. They cover basic research as well as applied science projects (Schmoch *et al.*, 2000[3]).

The **Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz** (WGL, *www.wgl.de*) joins 80 research institutes, each of them running a TT department. The leading organisation for institutes of applied research in Germany is the **Fraunhofer-Gesellschaft** (FHG, *www.fraunhofer.de*). This society covers about one third of its 1 billion Euro budget by mission oriented research and TT to private companies. The 58 member institutes run branch offices abroad, e.g. in other European countries, USA and Asia. These contact offices inform foreign partners easy overview about the whole research spec-

[1] Associated institutes are research institutes located at universities, but privately organised by different actors.

[2] *www.isi.fhg.de/publ/downloads/isi00b49/wissenstransfer.pdf,* and: Ulrich Schmoch, Georg Licht, Michael Reinhard: Wissens- und Technologietransfer in Deutschland, 2000, Fraunhofer IRB Verlag

[3] compare footnote 2 page 13

trum of the FHG. Some of the branch offices are allocated to research centres in the respective host country.

The **Max-Planck-Gesellschaft** (MPG, *www.mpg.de*) is Germany's largest private organisation for fundamental research, joining more than 80 research institutions. The institutions concentrate mainly on high-end research, while TT only plays a minor role (Schmoch *et al.*, 2000[1]).

In the sector of public research many foundations and associations are active in world-wide TT. Many universities have own contact offices for TT.

The **Garching Innovation** (GI, *www.garching-innovation.de*) was founded as central office for patents and licences for the Max-Planck-Gesellschaft. GI acts as mediator between research and industry, consults institutes with respect to their results, innovations and possible patents, informs interested enterprises and negotiates licence contracts.

More than 500 transfer institutions are joined in the **Steinbeis Foundation** (*www.steinbeis.de*), interlinking partners in more than 40 countries worldwide.

To promote the transfer of research ideas into products and services, Germany's research umbrella organisation, the **Deutsche Forschungsgemeinschaft** (*DFG, www.dfg.de*) established an 'Ideenwerkstatt' (*www.dfg.de/ideenwerkstatt*) (workshop of ideas), acting as moderator between science and economy. It provides a free service for scientists to help in development and marketing of innovative ideas.

3.3.3 Technology Transfer Institutions in the Private Sector

The 81[2] **Chambers of Commerce and Industry** run a technology market (*www.technologieboerse.ihk.de*), to enable contact between providers and users of technology. The German **chambers of foreign trade** (*www.ahk.de*) act as contact nodes for enterprises willing to establish trade abroad. Some chambers established **environment managers** who provide consulting service for enterprises in the sector of environmentally friendly and sound technologies.

In the private sectors, chambers of commerce and of foreign trade and industry institutes are active in TT.

The central interest of the **German Federation of Industrial Cooperative Research Associations** (Arbeitsgemeinschaft industrieller Forschungsvereinigungen 'Otto von Guericke' e.V. (AiF, *www.aif.de*) is to facilitate research interlinked to SME (small and medium-sized enterprises). For this purpose, AiF built up an infrastructure consisting of more than hundred industrial research institutes, about 50,000 SME, and about 700 embedded research units and two offices, in Berlin and Cologne, respectively. At the European and international level AiF acts via the **European Association of Research and Technology Organisations** (EARTO, *www.earto.org*), the Coordination Office of European Science Organisations

[1] compare footnote 2 page 13

[2] Germany is structured into 56 areas for chambers of commerce, due to historical and administrative reasons. Regionally, these areas split up into 81 chambers.

(KoWi, *www.kowi.de*) and via the 'Network of International Technology Cooperation' (intec-net, *www.intec.net*) of the **Federal Ministry for Economics and Labour** (Bundesministerium für Wirtschaft und Arbeit, BMWA, *www.bwma.de*).

The **Kreditanstalt für Wiederaufbau** (KfW, *www.kfw.de*) gives loans to enterprises and founders of new businesses (the total 2004 budget was approximately 63 billion Euros). In the name of the German Government, the KfW supports partner countries by investing into infrastructure like transport systems, energy production, communication technology or agricultural production. A majority of projects are related to access to social infrastructure like fresh water, health and education.

The **Internationales Transferzentrum für Umwelttechnik**, ITUT e.V. (*www.itut-ev.de*), was founded commonly by the German government, the industry and the government in Saxony. The aim is to support TT of environmentally sound technologies and knowledge in order to facilitate sustainable development in partner countries in middle and eastern Europe, the Newly Independent States (NIS), South East Asia, China, India, Latin America and South Africa. ITUT runs a cooperation exchange with numerous national and international partners[1].

The **German Information Secretariat of Biotechnology** (Deutsche Informationssekretariat Biotechnologie (*www.i-s-b.org*) is one example for a technology platform especially related to biotechnological issues. On a European level this service is provided by the **European Federation of Biotechnology** (EFB, *www.efbweb.org*).

The **Bionik-Kompetenz-Netz** (BIOKON, *www.biokon.net*) is a competence network of institutions in the field of bionics and is funded by the **Federal Ministry for Science, Technology and Education** (BMBF). Objective of the network is to tap the potentials of industry and science.

The **International Dialogue Centre Environment and Development** (Internationales Dialogzentrum Umwelt und Entwicklung IDCED) was established in 2003 with the help of the German Federal Ministry of Environment, the Deutsche Bundesstiftung Umwelt (DBU) and the Umweltinstitut IWU e. V. (*www.iwu-ev.de*) in Magdeburg. IDCED comprises the international project activities of the IWU from more than ten years in Eastern Europe and the former Soviet Republics. The institute is active in the field of environmental education especially for administrations and economic enterprises. The IDCED facilitates a multinational network of experts, supporting knowledge transfer and cooperation between enterprises especially in the field of water and waste management in Central and Eastern European countries.

[1] BMU, Saxonian Ministry for Environment and Agriculture, Foreign Office, BMZ, BMWA, DBU, Deutscher Industrie- und Handelskammertag, Ministries for the environment of other federal states, IHKs, UBA, KFW, Deutsche Ausgleichsbank, CUTEC Clausthaler Umwelttechnik-Institut GmbH, Leipzig Fair, Regional and local administrations, AHKs, Delegates and Representatives of German Economy in all South-Eastern-European States and Middle and Eastern European States, Environmental Protection Foundation of Letvia, Institut für wirtschaftliche Fragen der Naturnutzung (IWN) in Moscow, INEKO - Innovativer Fond für Umweltschutz, Moscow , Agentur für rationelle Energienutzung und Ökologie "ARENA-EKO" in Kiew, Wissenschaftliche Produktionsvereinigung "Interradioekologija" in Kiew, Belorussian Committee for the support of UNEP (UNEPcomRB), Environmental AreaManager in the AHKs in Prague, Budapest, Shanghai, Bombay, Jakarta, Kuala Lumpur, Bangkok, São Paulo, Mexico City und Santiago de Chile, and DGs and offices of the EU.

3.3.4 Technology Transfer Institutions of Non-Governmental Organisations

Apart from governmental institutions or private companies NGOs are also active in TT, e.g. via foundations or organisations based in churches. Some examples are the **Alexander von Humboldt-Stiftung** (AvH, *www.avh.de*), the **Deutsche Bundesstiftung Umwelt**, (DBU, *www.dbu.de*), the **Volkswagenstiftung** (*www.volkswagenstiftung.de*) or the **Daimler-Benz-Stiftung** (*www.daimler-benz-stiftung.de*), **'Misereor'** (*www.misereor.de*) or **'Brot für die Welt'** (*www.brot-fuer-die-Welt.de*).

In the NGO sector foundations, church organisations and organisations of development cooperation are active in biodiversity related TT.

The **Verband zur Förderung angepaßter, sozial- und umweltverträglicher Technologien e.V.** (AT-V, *members.aol.com/atverband*) is a network of about 90 independent consultants, researchers and trainers working in projects in many different countries. The focus of their expertise is on agricultural use, forests, use of natural resources, renewable energy sources and social development. The network members provide capacity building by running training and consultations.

The **Forum Umwelt & Entwicklung** (*www.forumue.de*) is a network of German NGOs[1] with contacts to organisations in developing countries. Activities are commonly planned with international organisations. The forum is supported by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and from the Federal Ministry for Economic Cooperation and Development. The forum is hosted by the Deutscher Naturschutzring e.V. (DNR) and the Verband Entwicklungspolitischer Nichtregierungsorganisationen (VENRO). The forum provides information about different subjects (as e.g. biological diversity, desertification, gender aspects, climatic change, tourism, marine environments) via press releases, position papers or other publications.

[1] E.g: AGRECOL e.V., AT-Verband, Attac, ARA (AG Regenwald und Artenschutz), Aktionsgruppe Babynahrung (AGB), Aktionsgemeinschaft Solidarische Welt e.V., AGEH, Afrikagruppe deutscher Geowissenschaftler, Bürgerinitiative Umweltschutz e.V. Hannover - BIU, BUND, BUKO Agrarkoordination, Brot für die Welt, BLUE 21, Deutscher Naturschutzring e.V., Deutsche Welthungerhilfe, Ecologic, Evangelische Kirche im Rheinland, Ev. Bauernwerk in Württemberg e.V., EED, Evangelische Kirche von Westfalen, FAKT, FIAN, FernWeh (im iz3w), Friedrich-Ebert-Stiftung, Greenpeace, GISAF e.V Berlin, GRÜNE LIGA Berlin e.V., Greenpeace, GERMANWATCH, GSE, Institut für Entwicklung und Frieden, Institut für Biodiversität - Netzwerk e.V. , informationszentrum 3. welt (iz3w), Institut für Klimafolgenforschung, Justitia et Pax, KATE - Berlin, Kath. Landvolkbewegung, Kath. Landjugendbewegung, Klima-Bündnis, Life e.V., Landesverband Bürgerinitiativen Umweltschutz, MISEREOR, Naturland e.V., Naturland e.V., NABU, Naturfreundejugend, NaturFreunde Deutschlands e.V., NRO-Frauenforum, Oekologischer Tourismus in Europa, Oldenburgisch-Ostfriesischer Wasserverband (OOWV), OroVerde, Pro Regenwald, Pesticide Action Network, Robin Wood, Stattreisen Hannover e.V., Stiftung Entwicklung und Frieden, Südwind, TBW, terre des hommes, Tourism Watch, Urgewald, VEN, Venro, Verein für Politische Bildung & Information, Verkehrsclub Deutschland e.V., Wuppertal Institut für Klima, Umwelt, Energie, WEED, Wuppertal Institut, Weltladen Dachverband, Weltfriedensdienst e.V., WWF-Deutschland, ZADI

Examples for biodiversity related TT via NGOs

Daimler-Benz-Stiftung (*www.daimler-benz-stiftung.de*)
- Sustainability in rural and urban environments (Yangon / Myanmar)
- 'Physics and Engineering' (Hanoi / Vietnam)

Volkswagen-Stiftung (*www.volkswagen-stiftung.de*)
- Knowledge for tomorrow – cooperative research (southern Sahara)
- Innovative methods for the production of functional surfaces

Misereor (*www.misereor.de*)
- Conservation of soil fertility (Sacaca / Cochabamba, Bolivia)
- Training small scale farmers (Sertao / Brasil)
- Training female farmers about sustainable land use (Zambia)
- Securing of fresh water resources (Ada Woreda / Ethiopia)

Brot-für-die Welt (*www.brot-fuer-die-welt.de*)
- Sustainable use of mangrove forests (PRODIPAN / Bangladesh)
- Traditional rice production (UBINIG / Bangladesh)
- Environmentally friendly production methods in land use (MONLAR / Sri Lanka)
- Guidance for rain water harvesting (ACORD / Uganda)

3.3.5 Selected Examples of German Technology Transfer Institutions and Approaches

From the multitude of actors listed above six selected examples are presented as leaflets on the following pages in more detail with respect to activities, mechanisms and services. These examples include permanent institutions as well as projects limited in time and are taken from the following sectors:

- GATE: public (national level)
- Cleaner Production: public (national level)
- Bayern Innovativ: public (regional level)
- RUN: public (national level), timely limited
- IDCED: private sector
- SES: NGO

Leaflet of GATE as an example of initiatives of the different sectors of technology transfer in Germany

	GATE
Name	German Appropriate Technology Exchange
Address	***www.gtz.de/gate***
	Section within governmentally funded Gesellschaft für technische Zusammenarbeit GTZ
Goals	Improvement of technological competence of NGOs dealing with development projects related to poverty reduction
Target groups	NGOs, organisations in developing countries
Technologies	Appropriate technologies (construction, energy, waste, water, and land use)
Relevance for Biodiversity	Conservation of ecosystems by reducing pressure (reduction of emissions, alternatives to fire wood, waste management, and reduction of water pollution), by use of natural resources (sustainable land use practises, biological pest control, use of local varieties, sustainable forestry, use of medical plants, non-timber products and dye plants)
Instruments	Question-Answer-Service, Databank for documents
Contact	direct questioning via internet, direct access to documents, and vice versa: needs assessment by GTZ members in the field and by active questioning at administrations and governments
Figures	• Nearly 2500 questions per year, 70% of them from NGOs or private users who get the service free of charge • More than 50% of the questions come from Africa • At average questions are answered within three days • 11 employees working for GATE
Relevance for CHM	GATE via GTZ has direct contact to many organisations in developing countries and can do direct needs assessment. This network could also be used for CHM. As the loss of biodiversity in developing countries is directly related to unsustainable production due to survival needs, the work of GATE for poverty reduction projects involves a target group for TT in the view of CBD i.e. the rural population in developing countries. Enhanced cooperation between CHM and GATE, therefore, could foster the 2010 target of reducing biodiversity loss. The question and answer service of GATE could be used as a model. GATE contributes to the activities also envisaged for the CHM, i.e. information platform, counsellor, competence network and transfer manager. GATE is member of the International Network of Technological Information (INTI), which could also be a model for CHM.

Leaflet of Cleaner Production Germany as an example of initiatives of the different sectors of technology transfer in Germany

Name	**Cleaner Production Germany** (CPG)
Address	***www.cleaner-production.de*** On behalf of the Federal Agency for the Environment (Umweltbundesamt UBA)
Goals	Cleaner Production Germany (CPG) is an internet portal informing about German environmentally related technologies and services. CPG also informs about national and international funding instruments and contacts for TT.
Target groups	Leading technical and economical experts, research institutes and administrations
Technologies	All environmentally related technologies, including high-tech e.g. for energy production, waste and sewage treatment, construction, noise reduction, reduction of air pollution, and biotechnologies
Relevance for Biodiversity	Conservation of ecosystems by reduction of pollution and pressure (emission control, alternatives to fire wood, water treatment, and waste management)
Instruments	Internet portal as meta-data-bank of documents and links
Contact	Access via internet, user seeks for answers, access is free
Figures	• More than 2500 information documents and summaries • More than 1500 examples describing state of the art for technologies • More than 1000 links to actors • Costs for maintenance stay with the provider.
Relevance for CHM	Cleaner Production Germany is an information platform requiring self initiative, technical skills and equipment from the user. A wide range of technologies with relevance for the environment and for biodiversity conservation is presented. The CHM could connect itself to that meta-data-bank as an important component for a comprehensive information platform. Nevertheless, CPG made the experience that an information platform causes permanent costs but standing alone is not enough to facilitate TT. Considering this, the CHM should do more than just provide information.

Leaflet of Bayern Innovativ as an example of initiatives of the different sectors of technology transfer in Germany

Name	**Bayern Innovativ GmbH**
Address	***www.bayern-innovativ.de***
	Founded in 1995 by the Bavarian Government
Goals	Support of innovation and knowledge transfer, development of concepts of thematic cooperation platforms in order to initiate future cooperation.
Target groups	Small and medium enterprises (SME), universities and research institutes
Technologies	Focus on 10 relevant technologies, e.g. biotechnology, chemistry, energy, medicine, and new materials
Relevance for Biodiversity	No special focus on biodiversity related technologies Biotechnology as thematic area (network 'Life Science Bavaria')
Instruments	Cooperation networks, internet platforms, mediation of personal contacts between holders and users, i.e. brokerage. Depending on the number of participants meetings are organised as one-on-one meetings, cooperation forums, technology symposiums or expositions.
Contact	Bayern Innovativ acts as an active transfer manager Contact via personal communication
Figures	• In 2003, cooperation platforms joined 10,000 participants from 30 countries. 600,000 queries on internet pages were registered, 70 TT platforms were held and newsletters were sent to 10,000 recipients. • More than 40 employees • Participants pay around € 280,-- for a two day international meeting • Control of success via number of facilitated cooperation and via amount of funds raised • Bayern Innovativ and it activities are financed by an annual budget of 3.8 million Euro from the Bavarian state, fundraising and participants fees for meetings and services. The total budget in 2003 was about 10.3 million Euro.
Relevance for CHM	Cooperation platforms in accordance to the number of participants are a positive example for active transfer management. Comparable platforms could be initialised via the CHM e.g. as side events of CBD meetings. The CHM could also use meetings facilitated via Bayern Innovativ to present information material. The methods used by Bayern Innovativ can be seen as a model for active transfer management.

Leaflet of RUN as an example of initiatives of the different sectors of technology transfer in Germany

	RUN
Name	Rural Universe Network
Address	***www.runetwork.de***
	Centre for agricultural documentation and information (Zentralstelle für Agrardokumentation und –information ZADI)
Goals	Decentralised, independent, inter-active, sustainable and needs oriented information system for rural development. Ideas, possibilities and solutions are discussed under active participation of local people. Thus, the information system is completely oriented at users needs.
Target groups	Rural population in developing countries without access to information. Focus areas via partner organisations in Benin, South Africa, Jamaica and east African countries.
Technologies	Simple land use technologies
Relevance for Biodiversity	Direct influence on biodiversity relevant production methods via capacity building and counselling
Instruments	• Direct needs assessment by providing the possibility to ask questions to experts • Implementation via local information brokers • Question-Answer-Service • Internet platform with tools, that allow use of internet for low costs • E-Journal for searching relevant publications (rural technologies) and for publication of own results • Control of success via number of vouchers cashed and local
Contact	Question-Answer-Service. Rural population gets vouchers for the answering of questions. Questions are asked to local brokers who transfer them to experts. Experts are paid via cashing of vouchers by the project. Subscription to e-journals.
Figures	• Provides up to 2000 publications documenting questions and answers • Publications are free of costs
Relevance for CHM	The voucher methods enables a target group with direct influence on biodiversity to ask questions without paying for the answers. The project acts as counsellor and reacts to actual needs. The voucher transforms information needs of the target group into explicit information demands.

Leaflet of IDCED as an example of initiatives of the different sectors of technology transfer in Germany

	IDCED
Name	International Dialogue Centre Environment and Development
Address	***www.idced.com***
	Section of the IWU – Institut für Weiterbildung und Beratung im Umweltschutz e. V., Magdeburg (www.iwu-ev.de)
Goals	Multi-national network of environmental experts in the new EU-Member States and Candidate Countries Knowledge transfer for the development of a local and regional environmental infra-structure in waste management, sewage treatment, fresh water management, efficient energy use, and renewables and industrial environmental management Making use of the experiences gained in the transformation processes during the German re-unification Support of German SME at national environmental markets
Target groups	Decision-makers in communal and regional environmental administrations and in medium sized enterprises and industrial unions in the new EU-Member States and Candidate Countries
Technologies	Communal water- and waste management Technical protection of the environment in industrial enterprises
Relevance for Biodiversity	Mitigation of environmental pressure via adapted (decentralised) solutions in the implementation of communal tasks and integrated solutions for environmental protection in the industry
Instruments	• IDCED Advisory Board (members from environment ministries, local government and industry associations and IHKs): consultations for the mid-term development of environmental markets • national IDCED-Centres: Networking and analyses of markets • Data bank for environmental infra-structure in the regions • Conferences, seminars, workshops and study trips for national experts and German business people • Implementation of projects for the EU, BMZ, BMU, UBA, InWEnt • Publications, news letters, internet presentations • Market analyses, contact mediation and consulting for enterprises with interest in environmental cooperation and Public-Private-Partnerships
Contact	Direct via personal requests to IDCED; Access via internet presentation; active research via IDCED in local administrations
Figures	The network is represented with national centres in Bulgaria, Germany, Hungary, Lithuania, Poland, Romania, and Slovakia, and has working contacts to the Czech Republic, Croatia, Latvia and Estonia. More than 7200 visits per month to the IDCED-Homepage (2004). IDCED-Newsletter twice a year to 4000 addresses in Germany. Participants to events: 500 (2004), 300 (1. half of 2005)
Relevance for CHM	IDCED maintains a multi national network for the provision of information and needs assessment for environmental technologies with focus on communal management and of industrial environmental protection in middle and south-eastern Europe. IDCED helps to analyse frame conditions for environmental cooperation. Knowledge transfer is an essential part of capacity building for the better implementation of the EU Environmental Acquis. IDCED contributes to information systems, capacity building and transfer management.

Leaflet of SES as an example of initiatives of the different sectors of technology transfer in Germany

	SES
Name	Senior Expert Service – Foundation of German Economy for international cooperation (Stiftung der Deutschen Wirtschaft für internationale Zusammenarbeit gGmbH)
Address	***www.ses-bonn.de***
Goals	Voluntary retired experts support education of qualified employees and managers in Germany and provide help abroad.
Target groups	Mainly small and medium enterprises, but also organisations and institutions like the EU, GTZ, or DED (German Development Service)
Technologies	all fields of technology, except armament technologies Examples: • Introduction of solar technology in Kenya • Development of bread varieties in Vietnam • Development of waste water treatment for a Chinese paper production plant • Treatment of hazardous waste in Brazil • Optimising of an ostrich farm in Ghana • Clean up of a dump in Mexico
Relevance for Biodiversity	No special concentration on biodiversity but with direct influence on daily behaviour via capacity building
Instruments	Direct mediation of experts and know-how
Contact	Request to central administration that connects to the experts
Figures	• Since its founding in 1983, about 14,000 actions have been undertaken in 152 countries, and in 2004, 1.435 actions took place. • 14 national offices, 91 international representations • Experts from more than 50 fields (e.g. electronics, engineering, agronomy, marketing, administration, chemistry, health care, and handicrafts) • More than 6,300 registered experts • Contribution to overheads of about 1,500 Euro (domestically) and up to 4,600 Euro (abroad), plus local costs • Many cooperation agreements with national and international organisations
Relevance for CHM	SES maintains a worldwide net of offices and representations that could be used for TT. The variety of technologies is high and biodiversity relevant aspects could be encouraged. Once having invested in the overhead costs, the help provided by the experts is direct, problem-oriented and effective.

List of some TT-Strategies used in Germany

In Germany very different strategies are used to enable actual TT. The following introduced some of these strategies and provide a reference to those institutions using these strategies.

TT Strategies	
Active brokerage [1] *P-to-C brokerage (Provider-to-Customer)*	**Active brokerage** [1] *C-to-P brokerage (Customer-to-Provider)*
Voucher System [2]	**Question-Answer-Service** [3]
Customer-oriented Information-Platform [4]	**Product-oriented Information-Platform** [5]
Technology-Agency [6]	**Needs assessment** [7]
Direct Marketing [8]	**Service Provider** [9]
Patent office [10]	

Actors use different TT strategies, from passive information offers to active brokerage between holders and users of technology.

Examples of institutions using the TT strategies mentioned above :

[1] WissRech - Institute for Scientific Investigation and Advice in Environmental Technology and Life Science (*www.wissrech.de*)

[2] RuNet – based at: Centre for Agricultural Documentation and Information (ZADI, (*www.runetwork.de*)

[3] GATE - German Appropriate Technology Exchange (*www.gate-germany.de*)

[4] Fraunhofer-Gesellschaft (FHG, *www.fraunhofer.de*)

[5] Chambers of Commerce (IHK, *www.ihk.de*), Cleaner-Production Germany of the Federal Agency for the Environment (*www.cleaner-production.de*)

[6] BayernInnovativ (*www.bayern-innovativ.de*)

[7] Institute for Facilitation of International Transfer of Environmental Technologies - ITUT e.V. (*www.itut-ev.de*)

[8] Garching Innovation GmbH of Max-Planck-Gesellschaft (*www.garching-innovation.de*)

[9] KMU Innovation & Venture Management (*www.kmuinnovation.com*), BTI Technology Agency Dresden GmbH (*www.bti-dresden.de*), LWF Transfer GmbH & Co. KG (*www.wftransfer.de*)

[10] German Patent Office (*www.dpma.de*), European Patent Office (*www.european-patent-office.org*)

The TT strategy used by the private institution **WissRech** (*www.wissrech.de*) is termed 'active brokerage provider to customer'. WissRech acts as provider by searching e.g. in universities for useful diploma or PHD theses or even initialises respective theses according to identified needs (raising producers interest). The interest of customers and users for relevant results or products is trying to be raised. This way of brokerage is termed 'active' because contact between parties is direct and personal. The strategy termed 'active brokerage customer to provider' works vice versa: the broker tries to detect or initialise solutions for customers needs, also via direct personal contact.

3.3.6 Two Examples of Web-based Information Providers

Web-based information offers, or so called web portals have been identified as an important medium for TT. These portals provide own information, collect information and link to other information offers. Out of the great variety of existing portals two examples active in TT are introduced in the following. Other existing information sources are commented under more general aspects:

Example 1: The pages of the Clearing House of the United Nations Framework Convention on Climatic Change (TT:CLEAR, *ttclear.unfccc.inf*)

Example 2: The TT-Platform Cleaner-Production of the Federal Agency for the Environment (CPG, *www.cleaner-production.de*)

Web portals have been identified as an important medium for TT.

Example 1 - Clearing House of the United Nations Framework Convention on Climatic Change: TT:CLEAR (ttclear.unfccc.int)

In 2002 the office of the United Nations Framework Convention on Climatic Change (UNFCCC) established a clearing house. Focuses of the portal are: enabling environment, capacity building, provision of expert's addresses, ways to get information, and information about existing projects.

The main goal of the web site is '*improving the flow of access to and quality of the information relating to the development and transfer of environmentally sound technologies (ESTs) and a more efficient use of available resources by providing a synergy with other ongoing efforts*'. The web site offers up-to-date information about technologies, access to data banks, publications and case studies.

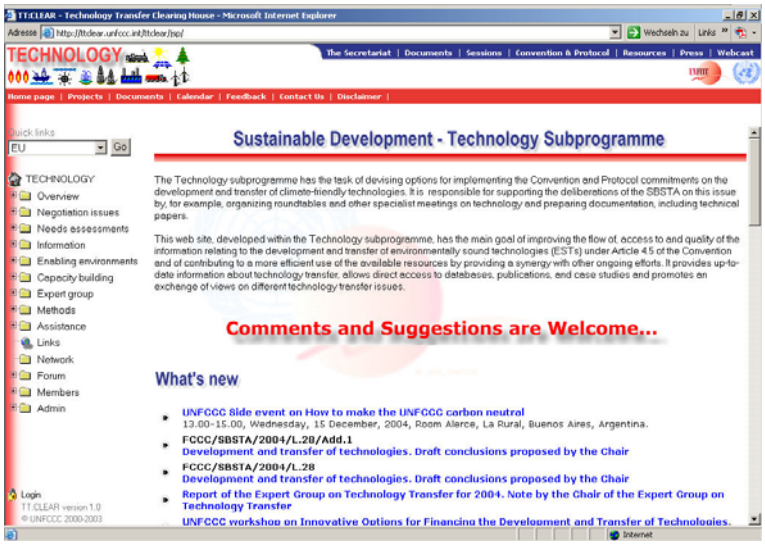

Figure 2 Website of the Clearing House of the United Nations Framework Convention on Climatic Change TT:CLEAR (*ttclear.unfccc.int*)

The information provided results mainly from strong interaction with other portals (e.g. Cleaner-Energy, Canada), from cooperation with other institutions and from documents and information media of the EU.

The portal lists more than 630 contact addresses from around the world (including a Roster-of-Experts) and maintains an extensive and well sorted collection of links on patent data banks, patent software, texts of respective legislation and a separate data bank holding abstracts of relevant TT projects. For Germany, momentarily, 54 projects were listed (Example: Testing Solar Stoves in South Africa, GTZ, 3 Million Euro, 1998 - 2000, *www.climatetech.net/pdf/Ctifull.pdf*).

Special features of the portal are a chat room and a web board. In the web board (situation in December 2004) 19 subjects are mentioned (under thematic areas, questions, problems, and points for discussion). All subjects were given by the creators of the web-site and date back to 2001. Obviously, the acceptance of the web board through users is low, as only for six subjects a single user has replied or formulated comments. Thus, the web board holds only 25 subjects. The idea of a chat room and a web board, which both work well as way of communication in other fields (e.g. computer problems or hobbies), seem not to be well accepted in this specific field of clime related technologies.

A small team is responsible for the portal. An employee of the office is responsible for maintaining the site, supported by colleagues. If needed, external consultants become involved.

The SBSTA Secretariat received two reports about the work, the usage, and the further development of the portal in 2004: (FCCC/SBSTA/2004/INF.8[1], 25 May 2004, and FCCC/SBSTA/2004/10[2], 21 September 2004).

The report of May 2004 provides the results of a poll for use and quality of the information provided by TT:CLEAR. The poll is based on 303 answers coming from 81 different countries. Accordingly, a majority (85%) regarded the web-site as useful for their own work. The quality of the information was referred to as good or excellent by 83% and 70% mentioned that the web site is well structured, is easy to handle, builds up quickly and can be used without difficulties. Comments of the users concerning possibilities of improvement or enlargement of the site were welcomed and proved to be very useful. Out of the variety of services the site offers, 'documents' were ranked as most useful (65%), followed by 'projects', 'technologies', 'contacts', 'models and tools', and 'links'. The categories 'news, calendar, events' and 'forum' were ranked as less useful (35%).

Example 2 - TT-Platform Cleaner-Production of the Federal Agency for the Environment (*www.cleaner-production.de*)

The platform 'Cleaner Production Germany' (CPG) of the Federal Agency for the Environment is active for about two years now. It provides information about the potential of German environmental technology and environmental services and about national and international funding instruments and contacts relevant for TT. The portal facilitates for foreign actors getting in contact with German actors and to initiate cooperation and business in the field of environmental technologies.

[1] *unfccc.int/resource/docs/2004/sbsta/inf08.pdf*

[2] *unfccc.int/resource/docs/2004/sbsta/10.pdf*

CPG deals with questions of technical environmental protection and thus targets technical and economic managers of institutions and enterprises. The platform provides information about important data sources with relevance for environmental aspects in enterprises, environmental technical research and development. A series of links connects to the most important institutions form industry, science and administration and the respective data banks.

CPG also gives basic information about projects dealing with technical environmental protection (title, abstract, supporting agency, etc.). The results of projects supported by public sources are presented or the access to these results is facilitated. The user is provided with project contents and is helped in getting access to further information.

Thus, CPG informs (source: *www.cleaner-production.de*):

- Potential users of environmental technologies about services of the German science and environmental industry, listed by thematic areas
- Foreign research institutions about the status of German research and development in the field of environmental technologies, and about possibilities of co-operation with German partners
- Administrations about the use of German environmental technology and experiences in enterprises
- Institutions in Germany and abroad, like chambers of commerce, bilateral foundations, NGOs and other TT institutions about the most important developments in environmental technologies in Germany.

The web-site of CPG contains the following sections:

- Technologies (waste treatment, sewage treatment, construction, biotechnology, energy, transport and vehicles, air pollution, noise reduction, surface technologies, and restoration)
- Industries (waste industry, construction industry, chemical industry, print industry, energy, wood and furniture, cars, agriculture and food, metal, paper and cellulose, minerals, clothes, and water and sewage)
- Addresses
- Funding
- Development
- International co-operation
- Environmental management

CPG provides a thematic overview over specific projects and the experts involved, and each project is introduced by an abstract. Additionally, extensive search functions, including key words and full text search possibilities are given. The portal was created on the behalf of the Federal Agency for the Environment (UBA), while numerous partners[1] form industry, development cooperation and environmental protection contributed to the contents of the site.

[1] Partners of Cleaner Production Germany: bfai - Bundesagentur für Außenwirtschaft, BMBF, BMU, BMWA, DBU, DIHK - Deutscher Industrie und Handelskammertag e.V., DLR., EFA - Die Effizienz-Agentur NRW, GTZ, ITUT e.V., KfW, PIUS-Internet-Portal, UBA, VDMA - Verband Deutscher Maschinen- und Anlagenbau e.V.

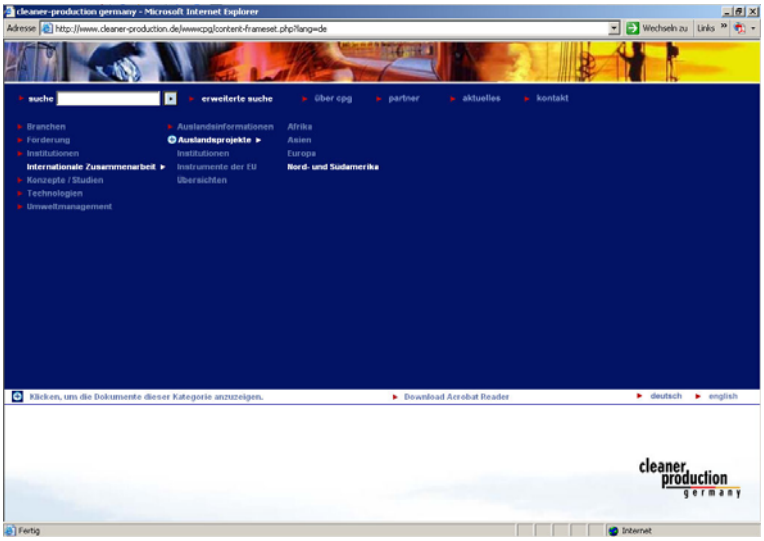

Figure 3 Web site of the TT-Platform Cleaner-Production of the Federal Agency for the Environment (*www.cleaner-production.de*)

Within UBA two employees are responsible for the portal, one being occupied just by maintenance of the site and keeping it up-to-date. Development and design of the site were done in cooperation with a software enterprise. The site is permanently being further developed and is partly financed by external funding. A relaunch is planned for the near future and co-operation with other information services will be extended. Besides the web-site itself, information material about the project lin the form of brochures and a CD are distributed and the project is regularly presented at various events. Topicality of the provided information is of utmost importance for UBA. UBA judges the relation between costs and benefits of the portal as 'very good'. During January 2005 the portal was visited by about 14,000 registered visitors and about 40,000 documents (PDF-files) were downloaded. Approximately 40% of the request came from abroad. A recent evaluation is still under work. This campaign includes a poll, in order to better react on user's needs and wishes.

For the time being, the site is presented in German and English. In the context of the 'German-Japanese Year 2005' the site will also be presented in Japanese and Korean.

3.3.7 Conclusions from existing Technology Transfer Institutions and Technology Transfer Strategies

The previous chapters showed the existence of different ways to deal with the subject of TT. It was indicated, for example, that there are **active** and **passive** strategies and, among others, **provider-oriented** and **customer-oriented** strategies. Implementation instruments include **personal face-to-face contacts, events** (workshops, fairs etc.) or **anonymous use of data banks**.

Each strategy and instrument should be adapted to the respective goals and target groups, which have to be clearly defined in order to develop and implement an optimum strategy. It would, for instance, not be very helpful to create a passive and highly technological data bank for the target group of 'rural population of developing regions'. In the same sense it would be not reasonable to perform great events for the presentation of a certain technology if the provider acts only on a small budget. The example of the chat

room on the site of TT:CLEAR (page 25) shows that instruments that might work well in certain thematic areas may not be accepted in others.

Depending on the kind of technology the degree of topicality of the information provided is of crucial importance. This is especially true for high-tech industries like bionics or biotechnology, where universities, research institutions or research departments of private enterprises constantly develop new ideas or improve existing technologies. In these thematic areas only the newest technology is wanted, independent from the way of brokerage. For a broker, this results in the need to permanently follow up and provide information about new developments, which requests financial and personal resources.

Degree of topicality of the information provided is of crucial importance in high tech.

In the field of classic technologies, which are often in the public domain, this need for permanent actualisation of information is lower. Many technologies for sustainable farming, for instance, are well-known but are nevertheless not implemented in many regions. In these cases the obstacle is not a lack of information but the impossibility of even small investments by a majority of potential users.

To **combine different TT strategies** and thus broaden the possibilities of mediation has proven to be a successful way (e.g. Bayern Innovativ, Chapter 3.3.5, page 17). It is worthwhile e.g. to **provide a data bank and organise mediation events**.

Furthermore, it is advisable to get partners and multipliers on board and integrate existing structures into the own strategy. It might be, for instance, possible to use the contact offices of the Fraunhofer-Gesellschaft abroad or the agencies abroad of the foreign office for a TT in the sense of the CHM, since there are such a high number of TT institutions in Germany.

Combination of different TT strategies has proven to be successful. Existing structures should be integrated into the own strategy.

3.4 Trondheim Conference on Technology Transfer

The '*Norway/UN Conference on Technology Transfer and Capacity Building*' (*www.dirnat.no*) took place in Trondheim from June 23.- 27 2003 and was hosted by the Norwegian Government and the UN.

This meeting of international experts on TT was taken as an opportunity by the authors of this study to interview participants about the importance of recent and future TT in their respective countries. In order to be able to compare the answers, the questionnaire used for this poll was developed following the questions that the CBD Secretariat had issued for the preparation of National Reports[1]) Although the 188 Parties to the CBD had been asked to hand in such National Reports as early as April 2002 (COP 6, Decision VI/25) with a deadline of 31 March 2003 and an extended deadline of 31 May 2003, there where only 10 such reports handed in to that date[2]. Thus, the questionnaire opened up the possibility to get additional information.

[1] *www.biodiv.org/world/reports.aspx?type=ttc*

[2] *www.biodiv.org/doc/meetings/cop/cop-07/information/cop-07-inf-09-en.pdf*

Some of the participants were representing the relevant TT institutions of their national governments, others came from national or international NGOs. The personal experience in the field of TT differed significantly between the participants. Therefore, the answers to the questionnaires were only taken as personal opinions of participants and as stimulation for the study.

View points from the questionnaires filled in during the Trondheim Conference

- In many countries there is a lack of expertise, resources, capacity and co-ordination for a needs assessment in the field of TT.
- If the CHM wants to inform about possibilities of TT it has to take into account and inform about the legal aspects of the respective technology as well.
- Although policies and institutions for TT exist in many countries, only few mechanisms for TT are in place (e.g. data banks, contact platforms, question-answer services) and tools for easy access to technologies (e.g. funding programmes, guidance for patents) are rare.
- The enabling environment for some relevant technologies is still unsatisfying (missing security about legal aspects).
- A majority of the answering persons sees the main task of the CHM in its role as information platform, providing access to information about technologies. Active brokerage and on-line training with respect to thematic focuses is also demanded.
- In many cases the national CHM contains no information about actors of TT of the respective country.
- To the question how the CHM could perform its role in TT in the future only a minority answered with the option ‚as it is now'. The other options were all favoured in about the same manner (advisor, provider of strategies, advisory body on funding, ambassador for the TT- community, provider of input to projects).
- The majority of answering persons had been involved in TT by the following mechanisms: information exchange, training, access to scientific information, financial support for research activities.

The Conference Conclusions[1] stated that technology transfer and capacity building '*may contribute significantly to all three objectives of the convention*' but both topics are '*shrouded in a great deal of* ***misunderstanding and often confusion***'. An aim of the conference therefore was '*to provide an* ***opportunity for demystification*** *and getting insights into analytical frameworks as well as sharing of experiences and examples on good practices and measures in order to make these topics operational*'. It was also stated that biodiversity relevant technologies cover a wide range (compare Chapter 3.2, page 9).

[1] Proceedings of the Norway/UN Conference of Technology Transfer and Capacity Building, Trandheim, Norway, 2003

Challenges that need to be overcome are mentioned[1]:

- Insufficiently receptive social and economic conditions to allow successful technology transfer and capacity building;
- Inadequacy of information on available technologies;
- Uncertainty with respect to terms under which technology transfer could and should be undertaken;
- Lack of appropriate regulatory, financial and institutional frameworks to this end at the local, national and international levels.'

There is a need for clear information about existing knowledge and technologies. Better information management and easier access are needed. Synergies between biodiversity and development policies should be improved.

The conclusions make clear that there is a need for more **clear information** about existing knowledge and existing technologies, including those that are in the public domain and freely accessible. A **more pro-active role of the CHM** in this respect is demanded which correlates well with the answers to the questionnaire handed out to the conference participants.

It was also pointed out that '*there is also a need to develop concrete targets and **improved synergies between biodiversity and development policies**, with obligations and needs under other conventions, and between sectors at the national level*'.

The Trondheim Conference and the answers to the questionnaires have revealed that the interest in TT is strong, but that there are also many uncertainties about ways and possibilities. Better information management and easier access to relevant information is urgently needed in order to enable a TT according to existing needs.

3.5 Results from the National Reports on Technology Transfer and Cooperation

When the present study was finalised the CBD Secretariat had received 26 national reports (*Thematic Report on Technology Transfer and Cooperation*) that could be interpreted[2]. These reports originate to similar parts from developing and developed countries. As the CBD has 188 Parties, this results in an answering quota of only 13%. Therefore, the following analysis can only be provisional and relies partly on the published interpretation of the CBD Secretariat[3]. A more substantial analysis will be possible if the Parties begin to implement the activities agreed on in the Work Programme on Technology Transfer (e.g. needs assessments).

[1] compare footnote 1 on page 30

[2] *www.biodiv.org/world/reports.aspx?type=ttc*: Algeria, Australia, China, Germany, Former Yugoslavian Republic of Macedonia, the European Community, Finland, Gabon, Iran, Ireland, Japan, Canada, Columbia, Liberia, Mexico, New Zealand, Norway, Oman, Poland, Switzerland, Spain, Sri Lanka, Tajikistan, Thailand, Austria, The Untied Kingdom (as of May 2005).

[3] *www.biodiv.org/doc/meetings/cop/cop-07/information/cop-07-inf-09-en.pdf*

The reports differentiate between two categories of TT:

a) public technology transfer (by and between governmental institutions)

b) private technology transfer (involving private enterprises).

The technologies are referred to in three categories:

1. technologies in the public domain
2. proprietary technologies
3. technologies derived from traditional knowledge, innovations, and practices.

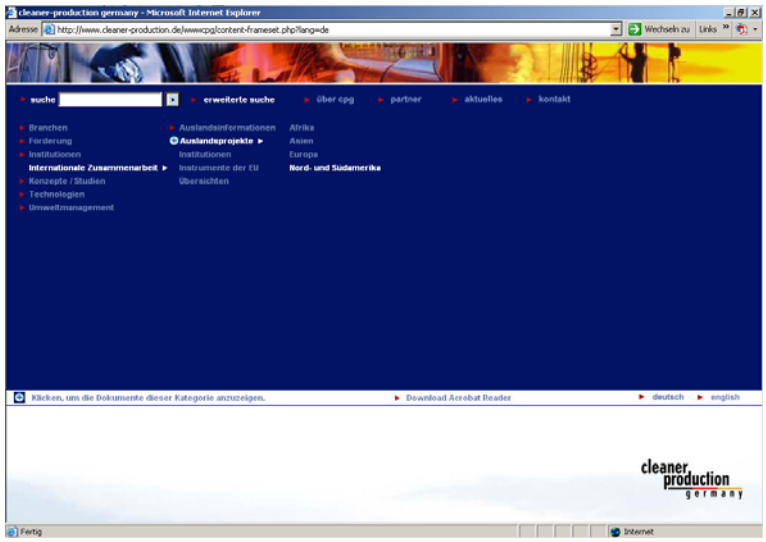

Figure 4 Web site of the TT-Platform Cleaner-Production of the Federal Agency for the Environment (*www.cleaner-production.de*)

The focus of the answers in the National reports is on TT via governmental or public institutions.

The focus of the answers in the national reports is on TT via governmental or public institutions. The importance of bilateral or multilateral co-operation is stressed, as well as the role of NGOs and the private sector. The reports mention activities to all four aspects of TT within the CBD, i.e. access to and transfer of technology (Art. 16), exchange of information (Art. 17), technical and scientific co-operation (Art. 18), and handling of biotechnology and distribution of its benefits (Art. 19).

Factors limiting TT are the lack of institutional capacity and expertise, limited financial resources, and missing access to information and training.

The technologies referred to in the reports are mainly technologies for the use of bioresources, biotechnologies and technologies to assess, monitor and manage biodiversity. Transfer of biodiversity friendly technologies or ecosystem technologies is mentioned only in passing and TT concerning bionics is not mentioned at all. That does not necessarily mean that there is no TT in this field. Technologies derived from traditional knowledge are not mentioned, as the catalogue of questions does not explicitly ask for these technologies[1].

[1] *www.biodiv.org/doc/meetings/cop/cop-07/information/cop-07-inf-09-en.pdf*

The question for the development of national policies and the establishment of national or international institutions for the enhancement of TT is answered in a positive manner in some reports, but details about the policies or institutions are not given.

The reports describe an extended variety of activities and actors in the TT, but the CHM plays a minor role, if mentioned at all. Only 12 of the 26 Parties that did hand in a report mention that their national CHM is developed as a tool for easy access to information about TT. Only six Parties (the EU, Finland, Poland, New Zealand, the United Kingdom, and Germany) give further explanations, but think mainly about the extension of the information provided by the CHM. Thus, they restrict the role of the CHM to a passive information platform.

The CHM of the CBD plays a minor role for TT in the national reports.
Only 6 of 188 Parties give further explanations how they use their CHM for TT. The role of the CHM is restricted to a passive information platform.
TT works best via active personal contacts.

If the CHM shall be developed into *'a central mechanism for the exchange of information on technologies ... and for facilitating technology transfer and cooperation and to promote and facilitate technical and scientific cooperation*', as foreseen by the COP[1], it will not be enough to keep the CHM just as an information platform and partly enlarge the information offer.

As revealed by the questioning of experts and as sustained by other studies dealing with TT (e.g. Schmoch *et al.*, 2000[2]), successful TT develops best if it is actively initiated, preferably via personal contact. How the CHM could play a more active role as counsellor, network of competence and transfer manager is described in Chapter 4, page 43.

3.5.1 Thematic Report of Germany

The National Focal Point to the CBD for Germany is hosted by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU, *www.bmu.de*). Germany handed in its Thematic Report on Technology Transfer and Cooperation to the CBD Secretariat on 31 May 2003[3]. This report gives an overview about TT in Germany, according to the questions posed by the Secretariat.

Since 1985 Germany supported about 360 projects world-wide, that contributed to the conservation and the sustainable use of biodiversity and in most cases included a certain transfer of knowledge and technology. These projects relate to biodiversity-relevant technologies in many different fields, e.g. sustainable land use, ex-situ conservation of species and genetic diversity, mitigation of by-catch in fisheries, or the use of renewable energy sources like solar or wind energy. A focus is given to the manifold activities of the Gesellschaft für Technische Zusammenarbeit (GTZ), who contributes to the implementation of the CBD in its programmes for agrobiodiversity (*www.gtz.de/agrobiodiv*),

[1] Dec. VII/29, 6 (a *www.biodiv.org/decisions/default.aspx?m=COP-07&id=7766&lg=0#* and *www.biodiv.org/doc/decisions/COP-07-dec-en.pdf*

[2] compare footnote 2 page 13

[3] *www.biodiv.org/doc/world/de/de-nr-stc-en.pdf*

for partnership between private enterprises and governmental institutions (*www.gtz.de/ppp*), and for the exchange of adapted technologies (*www.gtz.de/gate*). A programme directly aimed at the implementation of the CBD is also run by GTZ (*www.gtz.de/biodiv*).

The various research initiatives guided by the Federal Ministry for Education and Research (BMBF) also contribute to TT, among them the project PRO-Benefit dealing with access and benefit sharing in Ecuador (*www.probenefit.de*). Furthermore, there are measures for the ex-situ conservation in Germany, e.g. the 'International Plant Exchange Network' (IPEN), an initiative of the German botanical gardens and the participation in the Federal Information System on Genetic Resources (BIG, *www.big-flora.de*). This information system can be reached via the German CHM.

Germany undertakes many efforts to transfer knowledge to developing countries and stresses education and training of locals in its development cooperation. Most important in this context are the German Development Service (Deutscher Entwicklungsdienst DED), the Centre for International Migration and Development (CIM), and the Organisation for International Education and Development (Internationale Weiterbildung und Entwicklung INWENT). Germany is member of and/or supports many international organisations and networks, that contribute to biodiversity research and cooperation, as e.g. the Consultative Group on international agricultural research (CGIAR), the European cooperative programme for crop genetic resources network (ECP/GR), or the International Plant Genetic Resource Institute (IPGRI). With respect to the Global Biodiversity Information Facility (GBIF) Germany established a national focal point.

The present study about TT in Germany and the further development of the CHM is also announced in the National Report. The report shows that in Germany there exists a multitude of public funded projects and initiatives related to TT and cooperation. The report provides many links to background information as well.

3.6 National Expert Meetings

During the course of this study, a number of national experts from different TT institutions were invited to take part in two expert meetings in Wuerzburg. The meetings were held on 22 September 2003 and 16 January 2004. The invited institutions perform TT with different strategies and goals and represent a wide spectrum of different sectors, e.g. public sector, private sector or universities (compare Chapter 3.3, page 12).

The results of these meetings are presented in a condensed form as a series of statements related to the four programme elements of the Work Programme on Technology Transfer of the CBD. These statements are part of the basis on which the implementation scenarios in Chapter 4 (page 43) were developed.

Statements on Information Systems

- Mediation of contacts leads to development of cooperation
- Data banks and networks need permanent care-taking
- Question-Answer services can not be held up without regular funding
- Competence-catalogues[1] can quickly lead to direct contact
- TT is an endothermic process (needing energy input) and works only between persons (direct personal contact)
- Direct marketing and direct contacting of potential customers is the key to mediation between science and industry
- Data banks or experts lists without direct mediation are useless
- Help for the handling of data banks and search machines is required (Help-desk-services)

Statements on needs assessment

- GTZ: needs assessment via field representatives, direct questions to governments, scientific organisations or local communities
- RUN: Support of demand via voucher system for question-answer service in rural areas of developing countries
- Stakeholder-Analysis is basic requirement for effective TT
- Agreements on governmental level are not enough to encourage TT
- Some technologies ars selected for import depending on funding possibilities but not on real demand
- Needs assessment should follow scientific standards
- Needs assessment has to contact local people directly, and should not only rely on enterprises and governmental institutions
- Socio-cultural background in an importing country has to be taken into account (new technologies might need decades until being fully accepted
- A market for products resulting from new technologies must exist or be created (e.g. by incentives)

Statements on Capacity Building

- One way of knowledge transfer/capacity building from industrialised countries to developing countries could be to help to develop a national strategy for the use and transfer of technology
- Transferred technology needs also infrastructure
- Technology should be offered as package (including adaptation to local conditions and maintenance)
- The investor needs to have the competence to implement the technology. This might require training employees, transfer of environmental standards, measures for increasing educational levels.
- Investments have to be affordable for locals. This might need small loans.

Statements on Enabling Environment

- Enabling environment for investment has to be created (with respect to legal aspects, patents, import policy, and administrative regulations)
- Local people in developing countries must be enabled to search for new solutions for their problems (creating of a certain flexibility)
- There is a need for funding programmes, including institutional embodiment and control mechanisms

[1] Competence-Catalogues are a kind of ‚Yellow Pages' that list renowned experts for thematic areas.

- National strategies for TT and use of technology have to be developed, including the creation or shaping of responsible institutions
- TT has to be guided if certain goals are to be achieved (poverty reduction, conservation of biodiversity, etc.)
- Institutions controlling quality standards in the importing country are necessary. This can not be reached just by start-up projects limited in time.
- TT is such a wide thematic area that institutionalisation is required
- There are different goals of TT in the CBD:
  a) economic interest in spreading new technologies
  b) strengthening of export economy
  c) securing of environmental standards in developing countries
  (a) and (b) can by ruled by a free market, (c) needs the formulation of a strategy and the creation of institutions that can implement the strategy and control the outcomes
- The hindering effects of patents are recognised as more problematic than they really are, sine only a few big enterprises can afford world wide patenting.
- The obstacle for TT is not the existence of patents, but the lack of education, training and favourable conditions for the implementation of already existing technologies.
- There is a need for political will to accept knowledge and technologies.
- Conservation of biodiversity is in many cases of lower importance, if economic interests stand against it.
- Getting in contact often fails due to political obstacles.
- Contact and cooperation with scientists from other countries often fails due to preconditions set by other governmental institutions.
- Creation of a label is useful (example: INSTI *www.insti.de*).
- Start-up funding for multilingual employees and economic training is necessary.
- Access to markets in key countries is needed.

General Statements on TT

- Mediation of direct contact between scientists and enterprises can include profit sharing for the broker.
- Official TT offices of universities can not achieve active brokerage towards the industry.
- T-Cooperation is a better term as T-Transfer (includes common development of adapted technologies).
- Experience is that nobody wants to pay.

Statements on CHM

- Approximately 98% of TT is developed via personal contact (e.g. contact platforms).
- CHM as a platform has to facilitate personal contacts.
- Personal contact to decision-makers is often crucial for the success of TT.
- CHM must not be embodied too much as an institution.
- Creation of a TT networks makes only sense if there is an added value for all participants (e.g. additional research funds, personal resources or higher sales of products).
- A network directed to abroad can act on three levels:
  a) as a simple platform for the mediation of requests,
  b) as developer of brochures and actual answer service,
  c) as a network, that mediates sales and is economically oriented (Advertising platform).

Institutions taking part in the Expert Meetings

- Federal Agency for Nature Conservation (Bundesamt für Naturschutz BfN)
- DIVERSITAS
- WissRech - Institute for Scientific Investigation and Advice in Environmental Technology and Life Science
- Rural Universe Network (RUN)
- GATE – German Appropriate Technology Exchange
- Fraunhofer-Institute for System Technology and Innovation Research (ISI)
- Chamber of Commerce (IHK)
- Cleaner-Production Germany
- Bayern Innovative – Technology Marketing
- Institute for facilitation of international transfer of environmental technologies - ITUT e.V.
- Garching Innovation GmbH
- Institute for Ecological Economy Research (ioew)
- Institute for Biodiversity Research, University of Rostock
- Institute of German Industry, Cologne

3.7 Instruments of Technology Transfer

For the implementation of TT a multitude of instruments can be used, as listed in Table 2, page 38. The instruments listed in Table 2 can be internet based, but also using traditional media (paper), rely on portable media, mediate personal contact, provide guidance and services or bundle competence. The table gives an overview about such instruments and their possible quality, and mentions possible costs for users and providers. The implementation scenarios in Chapter 4 (page 43) of this study suggest a variety of these instruments in exemplary combinations in order to handle the tasks of the CHM.

Table 2: Instruments of Technology Transfers (Variations and Characteristics are structured by bullet points)

Instruments	Contents	Quality of Information	Costs for Provider (material and manpower)	Access and Costs for User
Internet				
Data banks	• Experts and their fields of expertise • Institutions and their research focuses • Enterprises and their fields of business • Box number offers and request for expertise, inventions and technologies	• no quality standards, data processing and data input by final user • Data filtration and – processing by TT-institution • Data processing and quality standards by selected providers, for free or with costs	• Costs for hardware and software for data banks, server, internet interface • Low manpower required for data bank administration if data processing and input is done by user • If data filtration is provided by TT institution more qualified manpower is needed, depending on amount of data • If data processing according to quality standards is done by selected provider a high amount of qualified manpower is needed • Costs can partly be covered by user fees	• Fully free of charge and searching done by user • Only abstracts free of charge, additional information and contact addresses only liable to fees • Only search mask with key words, results liable to fees
Subscription to data banks	• Defined by user via search mask	• Depends on the basic data bank and the search mask	• No costs if search masks work automatically • Income via subscription charges	• User gets new data per email • Free of charge or liable to fees
Web Boards	• Virtual black board	• Not moderated • Moderated, i.e. with quality control	• Material costs low • No manpower needed if not moderated • Manpower needed if moderated	• Mostly free of charge • Search done by user
Chat Rooms	• Direct exchange of information (no archive)	• Not moderated • Moderated, i.e. with quality control	• Material costs low • No manpower needed if not moderated • Manpower needed if moderated	• Mostly free of charge • Request by user
List Server	• Dissemination of information (information	• Emails distributed without filtration	• No costs without filtration • More manpower needed if filtration	• Mostly free of charge and freely accessible

Table 2: Instruments of Technology Transfers (Variations and Characteristics are structured by bullet points)

Instruments	Contents	Quality of Information	Costs for Provider (material and manpower)	Access and Costs for User
	flows only one way): e.g. current daily news and information, announcements • Discussion forum for users (information flows both ways)	• Emails filtered by moderator • Thematic restrictions or wide thematic range	is performed, depending on amount of data • Qualified personnel needed • Part of costs covered by subscription fees	
Newsletter	• Dissemination of information e.g. current daily news and information, announcements	• Quality controlled by editorial staff	• Production costs (editing, coordination of contributions, in part royalties) • In part qualified personnel needed • Part of costs covered by subscription fees	• User gets newsletter per email • Free of charge or liable to fees
Event Calendar	• Information about events with respect to TT	• Quality controlled by editorial staff	• Work depends on extend of calendar • Part of costs covered by subscription fees	• Mostly free of charge and freely accessible, sometimes fees
Checklists	• Instrument for the analysis of needs, possibilities of transfer of a technology, the market, funding issues etc.	• Partly very good quality, depending on provider	• High need of qualified personnel • Part of costs covered by subscription fees for downloads	• Mostly free of charge and freely accessible, sometimes fees
Toolkits	• Instructions / guidance for the use of technologies, methods	• Partly very good quality, depending on provider	• High need of qualified personnel • Part of costs covered by subscription fees for downloads	• Mostly free of charge and freely accessible, sometimes fees
Portable Media				
Printed Newsletters	• Dissemination of information e.g. current daily news and information, announcements	• Quality controlled by editorial staff	• Production costs (editing, coordination of contributions, in part royalties) • In part qualified personnel needed • Part of costs covered by subscription fees • Dissemination costs	• User gets newsletter e.g. by post • Free of charge or liable to fees

Table 2: Instruments of Technology Transfers (Variations and Characteristics are structured by bullet points)

Instruments	Contents	Quality of Information	Costs for Provider (material and manpower)	Access and Costs for User
Electronic Data Media	• Toolkits, checklists, publications, films, etc. on CD-ROM or DVD	• Partly very good quality, depending on provider	• Material costs for data media • Personnel costs depending on content • Dissemination costs	• Free of charge or liable to fees • Independent from internet
Brochures, Catalogues	• Presentation / Lists of technologies, providers etc.	• Partly very good quality, depending on provider	• High material costs • Personnel costs depending on content • Dissemination costs	• Free of charge or liable to fees
Direct Personal Contact				
Fairs	• Winning of new customers • Exchange of information	• Depending on fair management team	• Mostly costs covered by exhibition fees • Manpower needed for preparation	• Free access • Access only for members of specific institutions or groups • Free of charge or liable to fees
Technology exchange fairs	• Finding of partners as providers or users of products, technologies or services	• Normally oriented towards a specific target group	• Mostly costs covered by exhibition fees (in parts need of additional funding) • Manpower needed for preparation	• Free access • Access only for members of specific institutions, groups or funding programmes • Free of charge or liable to fees
Thematic conferences	• Exchange of specific thematic information	• Normally oriented towards a specific target group	• Mostly costs covered by exhibition fees (in parts need of additional funding) • Manpower needed for preparation	• Mostly access only for members of specific institutions, groups or funding programmes • Free of charge or liable to fees
Workshops	• Exchange of specific thematic information • In parts further development of specific thematic areas	• Specific towards target group • intensive exchange of specific information	• Manpower needed • Mostly costs covered by exhibition fees (in parts need of additional funding)	• Free of charge or liable to participants fees • Mostly invitation needed
Business travels	• Mediation of contacts • Getting knowledge about	• Normally oriented towards a specific target group	• Mostly costs covered by exhibition fees (in parts need of additional	• Mostly via membership in a certain association

Table 2: Instruments of Technology Transfers (Variations and Characteristics are structured by bullet points)

Instruments	Contents	Quality of Information	Costs for Provider (material and manpower)	Access and Costs for User
	• the market conditions • Preparation of deals	• direct contact to possible business partners	• funding) • Manpower needed for preparation	• Fees
Mediator / Broker				
Technology-Scouts / Technology Area Manager	• Active market observation • Search for new technology developments • Facilitation of cooperations	• Very specific towards target group	• High need for qualified personnel • Part of costs covered by fees	• Fees, in part external funding
Information- and Contact-Broker	• Facilitation of cooperations	• Very specific towards target group	• High need for qualified personnel • Part of costs covered by fees	• Fees in case of success
Mediation Agency	• Facilitation of cooperations	• Very specific towards target group	• High need for qualified personnel • Part of costs covered by fees	• Fees for requests
Advice, Service, Training, Public Relations				
Service / Information Offices	• Advice for start-up • Mediation of know how- and experts • Facilitation of cooperations • Advice on legal aspects of contracts, patents and use • Product- and innovation marketing • Project performance • Funding advice • Public relation with respect to TT	• Normally guaranteed by qualified personnel	• High need for qualified personnel • High material costs • Part of costs covered by fees	• Free of charge or liable to fees, depending on service
Training	• Thematic and leading competence • Facilitation of business plans • Acquisition of capital	• Mostly specific towards target group	• Part of cost covered by participants fees (in part need for additional funding) • High need for qualified personnel	• Liable to fees
Exhibitions , Days of Events	• Information for the interested public	• Mostly very clear by presentation of new	• Part of costs covered by entrance fees, normally need for additional	• Free of charge, free access • Entrance fees

Table 2: Instruments of Technology Transfers (Variations and Characteristics are structured by bullet points)

Instruments	Contents	Quality of Information	Costs for Provider (material and manpower)	Access and Costs for User
	• Creation of friendly conditions for innovations	technologies and discussions with qualified personnel	funding • High need for qualified personnel	
Structured Cooperations				
Networks	• Exchange of information • Facilitation of cooperation • Further development of thematic issues	• Mostly very specific for thematic issues	• Part of costs covered by membership fees • Qualified personnel need for coordination, depending on demand of the network	• Access via informal contacts or official invitation • Free of charge or low membership fees
Enterprise Pools	• Permanent lobbying for the interest of participating enterprises • Market access facilitated via Cost-Sharing and risk control • Information about the market specific to products or technologies • Mediation of contacts, exploratory talks, preliminary • Preparation, service and follow up for business travels and fairs	• Common interests of participating enterprises leads to targeted exchange of high quality information	• Costs normally covered by enterprises • Manpower needed for coordination • Qualified personnel needed for specific services • Material costs	• Equal access to resources (office infra structure or pool personnel) • Cost sharing
Technology Cluster	• Virtual or physical concentration of research institutions or enterprises for a specific	• Specific exchange of experiences • Targeted funding	• Normally additional funding required, part of costs covered by participants • Manpower needed for coordination • Qualified personnel needed for specific services • Material costs	• Free of charge or liable to fees • Access via research or industrial funding programmes

4 Action-oriented Recommendations and Conclusions

The previous chapters showed that a multitude of actors participates in Germany on national TT, using a wide range of instruments and strategies and covering different fields of biodiversity-related technologies. Chapter 4 of the present study tries to integrate the results and findings into a broader context and formulates action-oriented recommendations with respect to the role of the national CHM as possible actor of TT. The different tasks that the CHM could cover are devided into **four fields of action** (see Figure 5, page 43):

1st: First field of action: the CHM acts as **information platform**. This function is the principal task of the CHM as information system of the CBD.

2nd: A second field of action the CHM could additionally take over a **counselling function** by commenting pieces of information, and offering toolkits or guidance as basis for decision-making.

3rd: In the third field of action the CHM could be **partner and moderator of a national network of biodiversity related technology transfer.**

4th: In the fourth field of action the CHM would act as an **active transfer manager**.

For the practical implementation for these tasks three scenarios are developed:

- **Scenario I**: The CHM as information platform
- **Scenario II**: The CHM as partner (moderator) of a national Network of biodiversity related Technology Transfer Competence
- **Scenario III**: The CHM as transfer manager

Each scenario describes tasks and instruments, and can be seen as a further development of the previous one. From one scenario to the following the tasks covered by the CHM get increasingly complex, the number and intensity of implementation instruments rises and the resources needed for realisation grow. Implementing these scenarios would transform the CHM from a passive information platform to an active broker of TT.

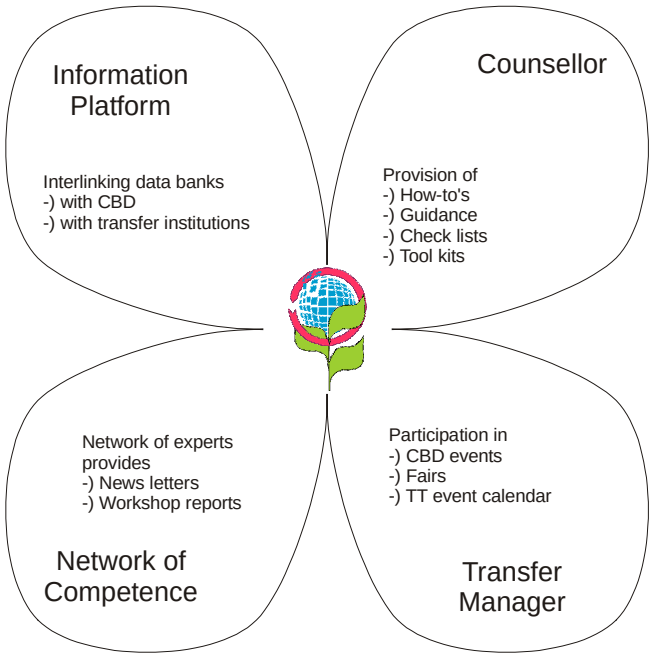

Figure 5 Possible fields of action for the CHM

4.1 Scenario I: The CHM as Information Platform

CHM as information platform fulfils the requirements of programme element 2.

In Scenario I the CHM acts mainly as information platform and as basically passive provider of information. The implementation of this field of action is the fulfilment of the requirements from programme element 2 (information systems) of the respective work programme of the CBD and has to be achieved by a properly working CHM.

Nevertheless, the present study shows, that a passive information platform is not sufficient for really mediating TT. Therefore, if the CHM wants to be used for support to further fields of action as described in the other programme elements (needs assessment, enabling environment, capacity building), a step to a higher level of quality has to be performed, going beyond just an information platform (see Scenarios II and III, page 45 and 46).

A passive information platform is not sufficient for really mediating TT.

Scenario I: Tasks and instruments

Tasks:

- to promote of the CHM as such
- to collect, process and provide information about actors and institutions of TT and about technologies on a regional, national and European level
- to keep the information up-to-date
- to provide best-practice examples of successful TT
- to index data banks of relevant industrial associations, expert groups, scientific communities, bilateral associations for economic development, systems of economic incentives as sources of information

Instruments:

- Well maintained web-site
- Electronic newsletters informing about new contents of the CHM, new developments of the CBD and with special issues covering thematic areas or selected technologies
- Web-Board as possibility of information exchange
- Calendar of events or event-compass for CBD-relevant TT
- Linkage to data banks and information systems
- Posters about CHM and TT via CHM
- Development of portable media like brochures and CDs

4.2 Scenario II: The CHM as Partner (Moderator) of a national Network of biodiversity related Technology Transfer Competence

Scenario II in comparison to Scenario I describes the CHM as an improved and more active information platform and assigns an additional counselling function. As a step to a higher quality level, Scenario II develops the CHM as partner and possible moderator of a network of competence.

Scenario II integrates Scenario I, but is enhanced in important parts. The implementation of Scenario II is ambitious, but would enable the CHM to fulfil its tasks as assigned by the CBD work programme much more profoundly.

The CHM, as envisioned in Scenario II, would refer to these requirements in its counselling function and guarantee permanent feedback from the members of the network of competence. This feedback would secure that toolkits and other guiding recommendations are realistic enough for implementation and are related to practice.

Scenario II: Tasks and instruments (including Scenario I)

Tasks:

- to fulfil a moderation function of a national network of biodiversty related technology transfer competence
- to bring together existing national competence
- to create and moderate a national network of biodiversity related technology transfer competence

Instruments:

- Provision of information platform at least in one UN language and newsletters also in printed version
- Support on effective search for relevant information in the internet
- Organisation of regular meetings among national partners biod TT network in order to create a network of competence, including participants from TT-institutions, industry, nature conservation associations, fair trade organisations etc.
- Facilitation of workshops for knowledge transfer and development of concepts for further development of TT approaches, political conditions etc
- Documentation and dissemination (via newsletter) of information and recommendations from exchange of experience and workshops in order to improve the information platform

4.3 Scenario III: The CHM as Transfer-Manager

On a higher level of quality the CHM takes over a mediation and promotion function as an active transfer manager. This would be a new dimension for the CHM.

Scenario III is a further widening of the tasks of the CHM in order to provide support to all four programme elements. The CHM takes over a mediation and promotion function as an active transfer manager, in order to bring providers and users of technologies into contact. This function can be fulfilled on request or on own initiative. This would be an enhancement of existing activities of the CHM. Acting on an even more enhanced quality level than in Scenario II.

This new function as an **active transfer manager** would open a new dimension for the CHM, which, nevertheless, is requested by the work programme of the CBD (compare UNEP/CBD/COP/7/L.20, 2.1.2[1]: *'To enhance the clearing-house mechanism, including its national nodes …. as a key mechanism for exchange of information on technologies and as a core element in its role to promote and facilitate scientific and technical cooperation, for facilitating and promoting technology transfer…'*).

Scenario III: Tasks and instruments (including Scenario II)

Tasks:

- to further promote the CHM
- to enhance the information platform into a discussion platform for TT
- to enhance counselling function from passive provision to active counselling
- to mediate TT as an active broker

Instruments:

- Dissemination of information about the CHM
- Facilitation of chat rooms for relevant topics
- Calling for on-line-discussion-forums
- Facilitation of a service office
- Initiation of training measures
- Using of CBD-related meetings for facilitating contact between TT-actors and the CBD
- Presentation of the CHM as information platform, counsellor and facilitator of a national network of biodiversity competence for example thematic conferences
- Enabling of access to thematic conferences for selected representatives of developing countries i.e. organisation of funding as an active broker
- Initiation of technology fairs of CBD-relevant technology sectors
- Initiation of a certification system or quality certificate for CBD-relevant technologies

[1] *www.iisd.ca/download/pdf/enb09284e.pdf*

4.4 Future potential Activities of the German CHM

The CBD work programme in its four programme elements assigns different functions to the CHM. The present study develops proposals for the implementation of the resulting tasks. The work programme sees as main contribution of the CHM to TT that '*National, regional and international information systems for technology transfer and cooperation provide comprehensive information of relevance to foster technology transfer and technology cooperation*' (objective of programme element 2).

Scenario I describes this role of the CHM as information system and lists tasks and instruments for the implementation.

Scenario II enhances the tasks of the CHM as an information platform. In this scenario the CHM also fulfils a counselling function by providing guidance. The CHM could act as partner and moderator of a national Network of biodiversity related Technology Transfer Competence. Such a **network of competence** should then organise regular exchange of experiences between participants from TT institutions, the industry, nature conservation organisations, fair trade organisations, development cooperation institutions etc. The realisation of this scenario would be an important step towards the implementation of the tasks of the CHM defined as early as in Decision II/3 4.c (COP 2): '*The CHM should be developed by gradually building up its functions in response to clear and identified demand*'[1]. In a network of competence the demand could be identified from the perspective of different actors. Additionally, in many cases demands coming from outside could be directly answered by members of the network.

A further step in the development of the CHM is represented by Scenario III. The CHM would act as an **active TT broker**. This scenario integrated Scenario I and II and would actively try to foster TT by facilitating personal contact between providers and customers of biodiversity-relevant technologies. This would be a significant enhancement of the role of the CHM with respect to TT.

Potential Target Group of TT via the CHM

The CBD formulated the goal to significantly reduce the loss of biodiversity until 2010 and knowledge and technology transferred via the CHM should in the first instance help to reach this goal. One potential target group could be local communities or rural population who are relevant users of biodiversity.

Considering this the CHM should try to develop its role as mediator of TT to this potential target group, under the reflexion that:

1. local communities directly influence biodiversity;
2. many technical solutions already exist and could potentially be adapted;
3. local communities have limited access to relevant appropriate technologies;

[1] www.biodiv.org/decisions/default.aspx?m=COP-02&id=7076&lg=0: "*The Conference of the Parties decides [...] that the clearing-house mechanism […] should be developed: c) by gradually building up its functions in response to clear and identified demand based on experience gained and resources available.*"

The German CHM can act as an interface on bilateral national and international CHM of the CBD and thus facilitate connections between potential users / recipients of need technologies and the providing or developing these technologies. To channel questions, provide answers and to facilitate partner matching. The CHM leads to synergies between different actors and instruments, making TT more effective.

Proposals of the CHM on a wide variety of activities with respect to developing countries

With respect to the target group of the developing countries, as proposed in the previous chapter, different options for further activities of the CHM could be envisaged.

One further activity could be to facilitate access to those technologies that are highly demanded from developing countries and are not freely accessible. The CHM could facilitate a matchmaking function certain technologies out of the wide range of biodiversity-relevant technologies, following the identified demand of developing countries.

Furthermore, the CHM in its service function could facilitate seminars for handling protected technologies, patents or license agreements for participants from developing countries. The CHM would than act as service centre for easier access to selected technologies.

Another activity in which the CHM could act as service centre in the above mentioned sense is the field of genetic pollution. The rising use of genetically modified varieties in food production leads to increasing needs for control and monitoring measures. In many cases this requests sampling and measuring technologies that are not per se available in developing countries. Nevertheless, such technologies would be needed especially in developing countries where great parts of the population are directly using genetically modified organisms. The CHM in cooperation with the Biosafety Clearing House could provide information about relevant technologies for sampling, control and monitoring and access to such technologies. Similar needs can arise where invasive or imported species pollute the original gene pool of a region. This can also lead to a demand for the respective technologies.

A further activity in which the CHM could foster easier access to selected technologies is the field of 'caps'. Caps are definite upper limits of pollution that are allowed for a certain volume of air, water or soil. Regional and international agreements regulate trade with certificates originating from the definition of such cap values. This international trade with certificates can be a source of income for developing countries if they are able to measure their own pollutant emissions and measure, control and monitor the resulting pollution. The CHM could inform about the relevant technologies and about the respective cap values and trade options.

The real value of any TT lies in the local adaptation and integration of the technology on community or national level. The whole process integrates transfer of knowledge and hardware as well as capacity building, training and financial support. TT should enable the recipient to control and further develop the technology according to his needs so that it contributes in a sustainable way to strengthen local economies, to generate additional income and to reduce poverty.

5 List of Abbreviations

ARC	Agricultural Research Council South Africa
AHK	Aussenhandelskammer; Chamber of Foreign Trade
AiF	Arbeitsgemeinschaft industrieller Forschungsvereinigungen "Otto von Guericke"; German Federation of Industrial Cooperative Research Associations
AvH	Alexander von Humboldt Stiftung
BASIN	Building Advisory Service and Information Network
BCH	Biosafety Clearing-House
BfN	Bundesamt für Naturschutz; Federal Agency for Nature Conservation
BIG	Bundesinformationssystem Genetische Ressourcen; Federal Information System on Genetic Resources
BMBF	Bundesministerium für Bildung und Forschung; Federal Ministry for Science, Technology and Education
BMU	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit; Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
BMWA	Bundesministerium für Wirtschaft und Arbeit; Federal Ministry for Economics and Labour
BMVEL	Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft; Federal Ministry of Consumer Protection, Food and Agriculture
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung; Federal Ministry for Economic Cooperation and Development
CBD	Convention on Biological Diversity; Übereinkommen über die biologische Vielfalt
CGIAR	Consultative Group on International Agricultural Research
CHM	Clearing House Mechanism
CIM	Centrum für International Migration; Centre for International Migration
COP	Conference of the Parties; Vertragsstaatenkonferenz
CPG	Cleaner Production Germany
DBU	Deutsche Bundesstiftung Umwelt
DED	Deutscher Entwicklungsdienst; German Development Service
DFG	Deutsche Forschungsgemeinschaft; German Research Foundation
DLR	Deutsches Zentrum für Luft- und Raumfahrt; German Aerospace Centre
DNR	Deutscher Naturschutzring
EARTO	European Association of Research and Technology Organisations
ECP/GR	European Cooperative Programme for Crop Genetic Resources Network
EFB	European Federation of Biotechnology
EST	Environmentally Sound Technologies
FE	Forschung und Entwicklung
FHG	Fraunhofer Gesellschaft
GATE	German Appropriate Technology and Ecoefficiency Programme
GBIF	Global Biodiversity Information Facility
GMO	Genetically Modified Organisms, Genveränderte Organismen
GTZ	Gesellschaft für Technische Zusammenarbeit; German Society for Technical Cooperation
GURTs	Gene Usage Restriction Technologies
HGF	Helmholtz-Gesellschaft
ICRISAT	International Crop Research Institute for the Semi-arid Tropics

IDCED	International Dialogue Centre Environment and Development; Internationales Dialogzentrum Umwelt und Entwicklung
IHK	Industrie- und Handelskammer; Chamber of Commerce
INRAB	Institut des Recherches Agricoles du Benin
INSTI	Innovationsstimulation; Innovation Stimulation
intecnet	Network of International Technology Cooperation
INWENT	Internationale Weiterbildung und Entwicklung; International Education and Development
IÖW	Institut für Ökologische Wirtschaftsforschung; Institute for Ecological Economy Research
IPEN	International Plant Exchange Network
IPGRI	International Plant Genetic Resource Institute
IRC	Innovation Relay Centre
ITUT	Internationales Transferzentrum für Umwelttechnik
IWU	Umweltinstitut
KfW	Kreditanstalt für Wiederaufbau
KMU	Kleine und mittlere Unternehmen; Small and Medium Sized Enterprises
MPG	Max-Planck-Gesellschaft
NGO	Non Governmental Organisation; Nichtregierungsorganisation
NIS	Newly Independent States; Neue unabhängige Staaten
OECD	Organisation for Economic Co-operation and Development
RD	Research and Development
RUN	Rural Universe Network
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
SES	Senior Expert Service
SME	Small and Medium Sized Enterprises; Kleine und mittlere Unternehmen
TT	Technologietransfer; Technology Transfer
UBA	Umweltbundesamt; Federal Agency for the Environment
UFZ	Umweltforschungzentrum Halle Leipzig; Centre for Environmental Research Halle Leipzig
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climatic Change; Klimarahmenkonvention
VENRO	Verband Entwicklungspolitischer Nichtregierungsorganisationen
VSK	Vertragsstaatenkonferenz; Conference of the Parties
WGL	Wissensgemeinschaft Gottfried Wilhelm Leibnitz
WissRech	Institute for Scientific Investigation and Advice in Environmental Technology and Life Science
ZADI	Zentralstelle für Agrardokumentation und Information; German Centre for Documentation and Information in Agriculture
ZEF	Zentrum für Entwicklungsforschung; Centre for Development Research

Some practical observations and experiences on technology cooperation and transfer in the frame of German development cooperation focussing on rural populations illustrating its complex matter.

Annex 1:

Technology Cooperation and Transfer for Poverty Alleviation

by: Carsten Hellpap, GATE/GTZ
http://www.gtz.de/en/themen/umwelt-infrastruktur/oekoeffizienz/7023.htm

Introduction

Technology Cooperation and Transfer have contributed in the last decades to significant improvments of the livelihood of the poor in developing countries. Life expectancy in developing countries has increased over the past 30 years from 46 to 64 years; rates of infant mortality have halved; the proportion of children enrolled in primary school has increased by more than 80 per cent; adult literacy rose from 55 per cent in 1980 to 70 per cent in 1995; and there has been a doubling of access to safe drinking water and basic sanitation. Despite these achievements the world-wide situation of the poor is still dramatic:

- 1.2 billion people live still with less than 1 US $ per person and day;
- more than 2 billion people have no access to modern, efficient forms of energy supply;
- 1.5 billion people still live in inadequate shelter;
- 1 billion people have no access to safe water, and 2.4 billion have no sanitation;
- 826 million people continue to face regular hunger and long-term malnutrition;

In light of this human tragedy poverty eradication continues to be one of the key challenges for international development.

Poverty alleviation through strengthening the technological capability

Poverty reduction measures can be distinguished in three categories:

a) direct measures, which benefit directly the poor
b) indirect measures, which create better frame conditions having positive effects on the livelihood of the poor on the medium and long run,
c) general measures, improving the economical and living conditions in a region or a sector including those of the poor, but which do not directly target to benefit specifically the poor.

Typical measures of direct poverty reduction are projects aiming at income generation, or the provision of shelter, food or other basic goods or social services (health care, education). The prospects of these measures depend largely on the introduction and dissemination of new technologies through technology transfer. Micro-, small and medium scale enterprises will generate additional income if they achieve higher productivity, product quality and diversity through the use of innovative and more efficient technologies. Improved technologies, such as more efficient stoves, water pumps, solar

panels, appropriate building technologies or farming methods are likewise necessary to increase food production, to give more people access to drinking water, energy supply and shelter and to extend social services and communication. Thus, the introduction of new technologies among micro, small and medium enterprises through technology transfer is a key element to strengthen the economic potential of the poor contributing to poverty alleviation. To be effective, it has to be combined with a general improvement of the technological capability of micro and small entrepreneurs and that of other relevant actors, so that they are able:

- to analyse correctly their main technological problems,
- to identify and to evaluate potential technological solutions suitable to the specific needs,
- to develop existing technologies further or to select, adapt and disseminate innovative technologies through technology transfer,
- to evaluate the short, medium and long term effects of new technologies,
- and to adapt introduced technologies further.

In this sense, technology cooperation and transfer, intended to strengthen the technological capability of the poor, have not only to consider the financial resources for and the access to new technologies but also the necessary requirements of know-how and skills to use them.

Problems of the technological approach

The relevance of technological capability for the economic and social development of the poor has been demonstrated by many projects. Most of them had positive effects on the living conditions of their target groups. Nevertheless, the overall impact on poverty has been quite limited. Beside scarce resources and unfavourable frame conditions, the unsatisfactory impact of fostering the technological capability of the poor is also caused by the very limited possibilities for poor families to generate additional income. The experiences of many technology projects which tried to strengthen the economical potential of the poor showed that a significant increase of the productivity of small enterprises are extremely difficult to achieve due to low profit margins, marketing problems, competition with industrial and semi-industrial products and the lacking capability to compensate unforeseeable problems, such as increase of prices of raw material or yield losses. Most national economies leave only few niches for resource poor producers, offering favourable conditions for income generating activities. The most skilled and competent small farmers and entrepreneurs may be able to use these niches. This part of the target group benefits in general from technological support. The broad majority of poor families, however, has only a small chance to increase their income through new technologies. They will be able to improve their living conditions at best only in very small steps and as a long process. The degree to which they can use existing chances depends largely from their knowledge about the demand and requirements of the market and how to organise more efficiently their production or service.

Most small farmers and entrepreneurs are not competent enough in this respect. They will fail with improving their productivity on the medium and long run even if the production could be increased temporary or a new product line could be established with new technologies.

Another problem of the technology approach has been the local focus of most projects. Measures to develop technologies further or to introduce new technologies were quite often carried out on village, or community or in rare cases on district level. The new

technologies, even if they were successfully applied, did in general not spread automatically and rapidly to other villages, communities or districts. One reason is that poor families living outside the project area can not easily bear the risk of investing in new technologies, even if they are interested in these technologies. Due to their economic vulnerability they avoid cost effective changes of unknown risk and prefer to continue in the traditional way. They know, that the neighbour village started with the new technology only because they got support from outside. On the other hand many local groups are not interested to disseminate their technological innovations which gives them a privileged competitiveness in comparison to others.

Consequences for the technological cooperation within poverty alleviation strategies

There is no doubt that strengthening the technological capability of the poor can significantly contribute to poverty alleviation. Higher incomes of small farmers and entrepreneurs can be achieved to a large degree through increased productivity depending from technological changes. However, improvements of the technological capability have to be accompanied by a good business management competence, such as the competence

- to analyse and assess markets and market opportunities
- to analyse and assess strength and weaknesses of their own products/services
- to identify and evaluate potential solutions for overcoming weaknesses of products/services,
- to identify and solve problems causing unnecessary costs and affecting the efficiency of the production or service.

Strengthening the technological capability and improving the business management competence of the poor are two complementary elements necessary for a successful enhancing of the economic activity of micro, small and medium entrepreneurs. Both capabilities are preconditions, that poor families can increase their productivity, improve the quality of their products and use consequently existing commercialisation possibilities. If only one of both elements is supported there is a high probability that the project or programme will not be sustainable and have only a very limited dissemination impact.

Furthermore, technological oriented projects which want to achieve a broad impact will have to work more on national level and to tackle more structural aspects of technological development. Projects should deal with the improvement of the management methods and technological capability of small producers of a whole agricultural or industrial branch. Such a concept would have to start with a detailed need assessment on national level. For example, what are the most important management and technological problems of small cotton producers, or shoemakers or of small food industries. Based on this analysis a strategy has to be worked out how management and technological innovations can be introduced, disseminated and implemented in the branch.

The success of the whole process from need assessment to strategic planning and implementation will largely depend on the degree of participation of all relevant actors and the intensity of co-operation between them. For, the entrepreneurial capability (management and technological capability) of a sector is determined by the political frame conditions, the quality and focus of the education system, the efficiency of management and technological services and the competence of the enterprises. All factors are interlinked to each other forming a system, where a single component and the intensity of co-operation can either stimulate or hinder innovations (see table 1).

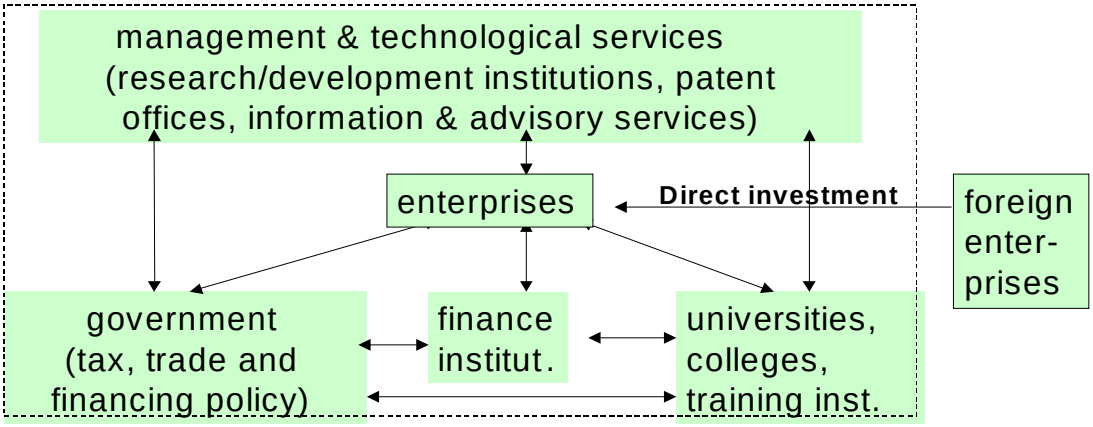

Table 1: Entrepreneural system

Based on this understanding two concepts have to be followed for promoting successfully and sustainably development and transfer of innovative management methods and technologies in the micro, small and medium enterprise sector of a country. On one side the interaction between enterprises, government, educational institutions and service organisations on communal, regional, national and international level has to be enhanced, including strengthening the participation of all involved groups to create optimal conditions for mobilising entrepreneurial self-initiative. The main activities comprise strengthening participatory processes in policy formulation and implementation (f.e. through institutionalising processes of participation and decentralisation), development of new forms of information exchange among actors, the organisation of information events, contact meetings, etc. and providing advise on financial investment strategies for environmental technology.

On the other hand single actors or groups of actors have to be supported to overcome institutional weaknesses which are bottlenecks for the innovation system: Such a capacity building will enable these actors to play a more active, professional and stimulating role within the entrepreneurial system.

Annex 2**:**

Checklist for selecting a technology within the scope of Technology Transfer

by: Carsten Hellpap, GATE/GTZ

Basic questions

What problem shall be solved with the technology? What is the purpose of the technology?

Which technologies may provide a solution to our problems?

How can we get sufficient theoretical and practical information about the different technological options?

Which technologies should be considered more in detail?

Questions to assess specific technologies

What are the investment and running costs of the technology?

What is the expected benefit of the technology?

What are (possible) side effects (economic, social, environmental effects)?

How robust is the technology (ie. in respect to climate factors, instable energy supply etc.)?

What is the expected life span?

What kind of spares does the technology need during the expected life span?

Which infrastructure and materials does the technology require (electricity?, special chemicals, raw materials, lubricants?)

What kind of knowledge und skills does the technology require?

Which organisational structure is necessary to use the technology?

Questions to the supplier of a technology (product)

What is the prize of the product? Are there any hidden costs?

Will the supplier provide me with a written detailed specification of the product and all its components?

Will the supplier provide a user manual in the local language?

Does the product come with a warranty? For which period? What kind of warranty?

What kind of after-sales support is provided?

Where are spares available, at which price?